JPRS-CST-92-004
20 FEBRUARY 1992

FOREIGN
BROADCAST
INFORMATION
SERVICE

JPRS Report

Science & Technology

China

DTIC QUALITY INSPECTED 2

19980512 114

DISTRIBUTION STATEMENT A
Approved for public release;
Distribution Unlimited

REPRODUCED BY
U.S. DEPARTMENT OF COMMERCE
NATIONAL TECHNICAL
INFORMATION SERVICE
SPRINGFIELD, VA 22161

Science & Technology
China

JPRS-CST-92-004 CONTENTS *20 February 1992*

AEROSPACE

Aerospace Agency Has High-Tech Itinerary *[Xie Liangjun; CHINA DAILY, 9 Jan 92]* 1
PRC Delegation Discusses Joint Space Project in Brasilia *[Luiza Pastor; GAZETA MERCANTIL, 13 Dec 91]* 1
Motion and Control of a Tethered Satellite System *[Zhu Renzhang; YUHANG XUEBAO, Oct 91]* 2
Two Optimization Problems for Dual-Reflector Antennas *[Wang Jueqi, Liu Hao; YUHANG XUEBAO, Oct 91]* 2
EM Scattering and RCS Analysis of Corner Structures *[Tian Jun, Ruan Yingzheng; YUHANG XUEBAO, Oct 91]* 2
Research on the Correct Principle and Method Applied to Optimization of Weapon System Plan in Cost-Effectiveness Analysis *[Xu Ande; YUHANG XUEBAO, Oct 91]* 3
Tactical Flight Management System for High-Performance Aircraft *[Gu Lei, Jin Changjiang; FEIHANG LIXUE, No 1, Mar 91]* 3
Test Study of Relation Between Aircraft Handling Qualities and Various Structural Parameters of Fly-by-Wire Control System *[Sun Goufan; FEIHANG LIXUE, No 1, Mar 91]* 3
Comparison Between Parameter Design and Test-Flight of Longitudinal FBW System *[Li Baolai; FEIHANG LIXUE, No 1, Mar 91]* 3

DEFENSE R&D

Domestic Development of Tactical Air-Defense Laser Weapons Described *[Ji Shifan; ZHONGGUO HANGTIAN, Dec 91]* 4

BIOTECHNOLOGY

Trial Run for Interferon Treatment *[CHINA DAILY (National), 9 Jan 92]* 5
Biotech Products Get a Boost *[Chen Qide; CHINA DAILY (Shanghai Focus), 2 Dec 91]* 5
High-Temperature DNA Sequencing *[Wang Lin; WEN HUI BAO, 28 Nov 91]* 5
Experimental Studies on the Transmission of HFRS Virus by Gamasidea Mites and Fleas *[Dong Bijun, Liu Zhiguang, et al.; ZHONGHUA YIXUE ZAZHI, Sep 91]* 6
Purification of Fragment AB of Tetanus Toxin and Its Activity *[Lei Dianliang, Morihiro Matsuda; SHENGWUHUAXUE YU SHENGWUWULI, No 5, Sep 91]* 6

COMPUTERS

Sino-Japanese Joint Development of Intelligent Computer Networks Described *[Liu Wentao, Li Guiqin, et al.; HARBIN GONGYE DAXUE XUEBAO, No 6, Dec 91]* 7
Superiority of Digital Neural Networks *[Chen Songcan, Yang Guoqing, et al.; JISUANJI YANJIU YU FAZHAN, May 91]* 10
New Joint Ventures With Japanese, Australian, U.S. Firms Announced 12
  Sino-Japanese Shanghai Sodick Software Ltd. *[Wen Yi; JISUANJI SHIJIE, 27 Nov 91]* 12
  Sino-Australian Injection-Mold CAE Co. *[Liu Wenhui; JISUANJI SHIJIE, 27 Nov 91]* 12
  Sino-U.S. Digital Systems Co. *[JISUANJI SHIJIE, 27 Nov 91]* 12
  Sino-U.S. Software Development Co. *[Jia Xiaohui; KEJI RIBAO, 11 Dec 91]* 12
  More on Stone Group-Digital Research Cooperation *[Xuan Gang; JISUANJI SHIJIE, 25 Dec 91]* 12
Nine GW Systems Support Software Products Commercialized *[Zhang An; JISUANJI SHIJIE, 18 Dec 91]* 13
State Invests 150 Million RMB in Expansion of GW's Production Base *[Liu Jiuru; JISUANJI SHIJIE, 18 Dec 91]* 13
Ergo 3.5-Inch Floppy Disk Drive on International Market *[Han Yun; JISUANJI SHIJIE, 4 Dec 91]* 13
New Anti-Virus Card Has Three Functions *[Wang Xuewu; ZHONGGUO DIANZI BAO, 18 Dec 91]* 13
CHINATRON Corp. To Promote CAD/CAM R&D Throughout Nation

[Zheng Genling; ZHONGGUO DIANZI BAO, 25 Dec 91] 13
Full Chinese-Language Documentation for UNIX V5.4 To Be Published
[Hai Ping and Han Yun; JISUANJI SHIJIE, 11 Dec 91] 14
Update on Eighth 5-Year Plan Computer Industry/ Applications Targets
[Xiao Yan; JISUANJI SHIJIE, 27 Nov 91] 14
Status of Domestic CAD Technology Described [Tang Zhaoqun; JISUANJI SHIJIE, 27 Nov 91] 15
Architecture of Domestically Developed HUASUN 4000-Series RISC Workstations
[Qiao Peng; XIAOXING WEIXING JISUANJI XITONG, Sep 91] 18

FACTORY AUTOMATION, ROBOTICS

Nation's First Independently Developed FMS Passes Technical Appraisal
[Gao Jingtai; ZHONGGUO KEXUE BAO, 24 Dec 91] 27
Second-Generation PLC Unveiled in Shanghai
[Ji Xianzhong; ZHONGGUO DIANZI BAO, 27 Dec 91] 27

LASERS, SENSORS, OPTICS

New-Generation Mid-to-Long-Range 3D Air-Defense Intelligence Radar Design Finalized
[Jiang Deqing; ZHONGGUO DIANZI BAO, 29 Nov 91] 28
Development of DBF Technology for Domestic Radar
[Tian Ding; ZHONGGUO DIANZI BAO, 8 Dec 91] 28
DC SQUID Magnetometer With Nb-SiO_2-Nb Edge Tunnel Junction
[Zhang Lihua, Chen Lie, et al.; YIQI YIBIAO XUEBAO, No 4, Nov 91] 28
Relativistic E-Beam Accelerator Used To Produce Cerenkov FEL Output
[Tan Keyang; KEJI RIBAO, 6 Dec 91] 29
Two Remote Sensing Project Achievements Pass Acceptance Check
[Zhong Ming; ZHONGGUO KEXUE BAO, 20 Dec 91] 30
CAEP Achieves Ne-Like Ge Soft X-Ray Laser Saturated Output [Hao Jin; KEJI RIBAO, 31 Dec 91] ... 30
Na-Like Cu Ion X-Ray Lasing at 72.22 Angstroms Achieved
[Lu Peixiang, Zhang Zhengquan, et al.; KEXUE TONGBAO, 16-30 Nov 91] 31
Electron Trajectories and Stability in FEL With an Axial Guide Magnetic Field
[Shu Xiaojian; WULI XUEBAO, Oct 91] 31
Stimulated Raman Scattering in Laser-Plasma Targets [Zhang Jiatai, et al.; WULI XUEBAO, Oct 91] .. 31
Industrial Computerized Fault-Detection Scanning Imager Developed
[Peng Dejian; ZHONGGUO KEXUE BAO, 29 Nov 91] 32

MICROELECTRONICS

Ku-Band GaAs Oscillator, Other MMICs Pass Appraisal
[Li Qiongrui; ZHONGGUO DIANZI BAO, 3 Jan 92] 33
Micro-Package Hybrid IC Product Series Unveiled
[Li Qiongrui; ZHONGGUO DIANZI BAO, 1 Jan 92] 33
Shougang Corp., NEC Form Microelectronics Joint Venture
[Shu Guang; ZHONGGUO DIANZI BAO, 20 Dec 91] 33
Hangzhou Corporation, Toshiba Corp. Form Joint Venture To Produce Spare Parts
[Lu Minmin; ZHONGGUO DIANZI BAO, 1 Dec 91] 33
Long-Wavelength Low-Dark-Current High-Speed $In_{0.53}Ga_{0.47}$ As MSM Photodetectors
[Shi Changxin, Klaus Heime; BANDAOTI XUEBAO, Dec 91] 34

SUPERCONDUCTIVITY

New World Record Established for HTS YBCO Critical Current Density
[RENMIN RIBAO, 23 Dec 91] 35

TELECOMMUNICATIONS R&D

Further Reports on Fiber Optic Communications 36
  Another Jiangsu Province Trunkline Built [Jin Yuqi; DIANXIN JISHU, Dec 91] 36
  Fujian Cable Under Construction [You Xin; KEJI RIBAO, 21 Dec 91] 36
  Beijing-Zhengzhou Railroad Communications Cable [Peng Hengcai; KEJI RIBAO, 30 Dec 91] 36

Fiber Coatings Domestically Developed *[Ruan Xianghua; KEJI RIBAO, 6 Jan 92]* 36
Zhejiang Eighth 5-Year Plan Projects Detailed *[Tu Tonghe; DIANXIN JISHU, Nov 91]* 36
Hunan Province Projects Described *[DIANXIN JISHU, Nov 91]* 37
Nanjing-Wuhu Railroad Communications Line Operational *[Yi Wu; ZHONGGUO DIANZI BAO, 8 Dec 91]* 37
Shanghai-Nanjing Cable To Be Operational by End of 1992 *[Xing Hua; JISUANJI SHIJIE, 11 Dec 91]* 37
High-Capacity SPC Digital Switch Domestically Developed *[He Huangbiao, Zhang Dongwen; RENMIN RIBAO, 15 Dec 91]* 37
Shanxi Plant Manufactures CDMA Satellite Datacom Network *[Gu Bingxin; ZHONGGUO DIANZI BAO, 13 Dec 91]* 38
Digital Microwave Projects Described 38
Contract Signed for Nanchang-Fuzhou DS4 Line *[Liu Jiuru; DIANXIN JISHU, Nov 91]* 38
'Shenda' Superhighway DS2 Line Operational *[Huang Wenquan; DIANXIN JISHU, Nov 91]* 38

PHYSICS

Electron-Positron Collider Technology Exported *[XINHUA, 24 Nov 91]* 39
Luminescence Advances in China *[Xu Xurong, Fan Xiwu, et al; WULI, Sep 91]* 39

Aerospace Agency Has High-Tech Itinerary

40100017 Beijing CHINA DAILY in English 9 Jan 92 p 1

[Article by Xie Liangjun]

[Text] The Ministry of Aerospace Industry has outlined its 1992 development targets, which focus on further expanding its international market and increasing research in aerospace technology.

This year will be a busiest in the industry's 40-year history, with more aircraft models researched and more satellites launched, Minister Lin Zongtang told an ongoing national conference yesterday in Beijing.

China will use Long March 2 carrier rockets to launch two Australian telecommunications satellites in March and autumn respectively, and launch a Swedish research satellite in October.

Lin said at the conference his ministry would continue to adjust its export product base and manufacture more high-tech products to expand China's role in the world market.

Lin also set $500 million in foreign currency as the ministry's export target for machinery and electronics made by its factories, $100 million more than last year's target.

He urged the use of aerospace technology to develop more civilian products and encouraged research centres, institutions of higher learning and enterprises to join to form high-tech development groups.

Lin's remarks were echoed by State Councillor Song Jian, also the minister in charge of the State Science and Technology Commission. Song said at the conference that putting aerospace products into the world market should be considered a long-term policy.

"It is the way for the development of China's aerospace technology," he said.

The State Council has decided that every enterprise should channel 1 per cent of its total sales volume into technological development, with higher percentages for high-tech firms.

Also at yesterday's press conference, ministry officials said that since China started reforms and open policies in 1979, the country has established co-operative ties in aerospace science and technology with many countries, including the United States, Germany, France and Sweden. Last year China signed cooperation agreements on aerospace technology with India, Pakistan and Italy.

Officials also said that since 1990, China has signed agreements with the former Soviet Union, and concerned departments in the republics of the new commonwealth have said that the recent developments will not affect these agreements.

Commenting on China's recent telecommunications satellite launch mishap, Minister Lin said, "We have already found out the cause of the malfunction and are confident that it will not occur in the future."

PRC Delegation Discusses Joint Space Project in Brasilia

92SM0172Z Sao Paulo GAZETA MERCANTIL in Portuguese 13 Dec 91 p 11

[Article by Luiza Pastor]

[Text] Brasilia—A mission from China's Ministry of Aerospace Industry was in Brasilia yesterday to meet with the secretary of science and technology, Edson Machado, and try to smooth the last of the rough edges hindering the progress of the Chinese-Brazilian program. The agreement, signed in July 1988 by then President of the Republic Jose Sarney, calls for building and launching exploration and remote sensing satellites SSR-1 and SSR-2, but it has been held up by Brazil's delay in releasing the funds and the lack of a more definite statement regarding the protection of industrial property and the transfer of sensitive technology to other countries.

Although the ministry's planning director, Zhang Rumou, made it a point to state that the mission he heads in Brazil is intended solely to "strengthen the ties of friendship and cooperation between the two countries," the true purpose of the mission is to review the real situation with the various disputes existing between China and several Latin American countries—chiefly in the technological area—in preparation for the upcoming visit to those countries by the chairman of the Chinese Communist Party in 1992.

But the Chinese leader was certainly not displeased by Secretary Edson Machado's announcement that this week the government would approve release of the funds enabling Brazil to pay its debt of $1.4 million by this coming 15 December [1991]. The country paid $625,000 of that amount this week.

Apart from the debts to be paid, the meeting by the mission's members with the secretary was also aimed at making progress with the negotiations begun during Machado's visit to Beijing in October. The purpose of those negotiations is to enable Brazil to participate more directly in Brazil itself in the building and testing of the SSR-2. But that decision will have to wait for one more meeting—this time with a technical mission that is scheduled to arrive in the second half of January. It is hoped that that meeting will also result in a more specific date for launching the SSR-1, which is scheduled to go into orbit in 1994.

"We also feel that the National Institute of Space Research (INPE) is in a position to take charge of controlling the satellite's flight, and we are also demanding that," said Machado, explaining that if agreement on those measures is reached with the Chinese, the terms of the original agreement will have to be revised. That revision would include the insertion of safeguards guaranteeing the security of the satellite, the launcher, and, chiefly, the technologies involved.

Motion and Control of a Tethered Satellite System

40100016A Beijing YUHANG XUEBAO [JOURNAL OF THE CHINESE SOCIETY OF ASTRONAUTICS] in Chinese No 4, Oct 91 (manuscript received 29 Mar 90) pp 32-42

[English abstract of article by Zhu Renzhang (Institute of Spacecraft System Engineering, CAST, Beijing)]

[Text] This paper presents an approach for the simulation of tether dynamics, a first step for the development of a comprehensive simulation tool. Such a tool is a necessary basis to decide whether it is favourable to use tethers in space scenario. The equations in the paper can describe the in-plane orbital motion of CM of the system and the three dimension relative motion of the subsatellite and the main satellite. Air drag action on the tethered bodies and the tether is considered, and the mass-exchange between the tether and the main satellite during deployment and retrieval is taken into account. The control strategies are investigated and evaluated. Simulations and conclusions are made.

References:

[1] Van der Ha, J. C.: "Orbital and Relative Motion of a Tethered Satellite System," ACTA ASTRON. 12, 1985, pp. 207-211.

[2] Modi, V. J. et al.: "On the Control of the Space Shuttle Based Tethered Systems," ACTA ASTRON. 9, 1982, pp. 437-443.

[3] Baker, W. P. et al.: "Tethered Subsatellite Study," NASA TM X-73314, 1976.

[4] Misra, A. K., Modi, V. J.: "Deployment and Retrieval of a Subsatellite Connected by a Tether to the Space" [as published].

[5] Bainum, P. M., Kumar, V. K.: "Optimal Control of Shuttle-Tethered-Subsatellite System," ACTA ASTRON. 7, 1980, pp. 1333-1348.

[6] Lakshmanan, P. K. et al.: "Dynamics and Control of the Tethered Satellite System in the Presence of Offsets," IAF-paper 1987, pp. 87-316.

[7] Lakshmanan, P. K. et al.: ACTA ASTRON. 15, 1987, pp. 1053-1057.

[8] Modi, V. J., Misra, A. K.: "On the Deploynamics of Tether Connected Two-Body Systems," ACTA ASTRON. 6, 1979, pp. 1183-1197.

[9] Sommerfield, A.: MECHANIK Bank 1., Lepzig, 1964.

[10] King-Hele, D.: "Satellite Orbits in an Atmosphere," Blacki, 1987.

[11] Regan, F. J.: "Re-entry Vehicle Dynamics," AIAA, Inc., 1984.

[12] Zhu Renzhang: "The Treatment to the Eular Angle's Singular Point in the Satellite Returning Motion Equations and Trajectory Computation," J. CHINESE SOC. ASTRON. 3, 1983, pp. 20-29.

[13] Press, W. H. et al., "Numerical Recipes," The Art of Scientific Computing," Cambridge, 1987.

[14] Zhu Renzhang: Cycle-Coverage Orbit Design and Orbit Maintenance for an Observation Satellite," Dissertation, Technische Universitat Munchen, 1989.

[15] Abramowitz, M., Stegun, I. A.: "Handbood of Mathematical Functions," New York, 1972.

Two Optimization Problems for Dual-Reflector Antennas

40100016B Beijing YUHANG XUEBAO [JOURNAL OF THE CHINESE SOCIETY OF ASTRONAUTICS] in Chinese No 4, Oct 91 (manuscript received 5 Feb 90) pp 83-88

[English abstract of article by Wang Jueqi and Liu Hao (Institute of Spacecraft System Engineering, CAST, Beijing)]

[Text] In spacecraft and Earth-station, the dual-reflector antennas are widely used nowadays. This paper discusses two optimization problems for dual-reflector antennas. As the main reflector is an existing paraboloid, the secondary reflector is shaped optimally so that as compared with the classical dual-reflectors (paraboloid-hyperboloid) the gain is increased by 0.48-0.40 dB (for $D/\lambda = 20\text{-}100$). The optimal design of offset cylindrical dual-reflector system is sought, so as to make the aperture distribution to be most approximate to that of uniform phase and amplitude when the feed pattern changes.

EM Scattering and RCS Analysis of Corner Structures

40100016C Beijing YUHANG XUEBAO [JOURNAL OF THE CHINESE SOCIETY OF ASTRONAUTICS] in Chinese No 4, Oct 91 (manuscript received 22 Mar 90) pp 89-94

[English abstract of article by Tian Jun and Ruan Yingzheng (University of Electronic Science and Technology of China, Chengdu, Sichuan)]

[Text] The corner structure is a strong scattering mechanism of many targets. The radar cross section of dihedral corner structure is studied in this paper by using the method of complex ray expansion. The calculation results agree very well with experiment results and other theoretical results.

Research on the Correct Principle and Method Applied to Optimization of Weapon System Plan in Cost-Effectiveness Analysis

40100016D Beijing YUHANG XUEBAO [JOURNAL OF THE CHINESE SOCIETY OF ASTRONAUTICS] in Chinese No 4, Oct 91 (manuscript received 24 Jan 90) pp 106-110

[English abstract of article by Xu Ande (Shanghai Aerospace Bureau)]

[Text] Cost-effectiveness analysis for weapons systems is a very important means for scientific decision-making in choosing weapon type, development and improvement. For the cost-effectiveness analysis to establish correct principle applied to optimization of weapon system plan is a key problem. In this thesis the correct principle and method applied to optimization of weapon system plan in cost-effectiveness analysis have been studied. The uncommon views about general principle known as "the ratio of effectiveness to cost" have been particularly put forward. From the thesis analysts and decision makers can find some defects or mistakes of using "the ratio of effectiveness to cost." In addition the author has researched the great influence of schedule on cost and effectiveness and stands for "making the three-dimensional tradeoff (effectiveness, cost and schedule)."

Tactical Flight Management System for High-Performance Aircraft

40100012A Xian FEIHANG LIXUE [FLIGHT DYNAMICS] in Chinese No 1, Mar 91 pp 1-7

[English abstract of article by Gu Lei and Jin Changjiang of Beijing University of Aeronautics and Astronautics; MS received 25 Feb 90]

[Text] A Tactical Flight Management (TFM) system has been developed that incorporates system concepts for enroute navigation, energy management, threat penetration, terrain following/terrain avoidance, and advanced maneuvering weapon delivery. Flight management technology to automatically couple advanced weapon delivery capability to the flight control system has been developed in the Integrated Flight/Weapon Control program. Approaches to coupling the navigation system to the flight control and propulsion control system have been studied in the Integrated Flight Trajectory Control program. Advanced penetration concepts have been investigated in the Advanced Terrain Following/Terrain Avoidance. A Tactical Flight Management system is described which builds and expands on these technology foundations to develop a unified, full-mission system which significantly improves effectiveness and survivability.

Test Study of Relation Between Aircraft Handling Qualities and Various Structural Parameters of Fly-by-Wire Control System

40100012B Xian FEIHANG LIXUE [FLIGHT DYNAMICS] in Chinese No 1, Mar 91 pp 46-57

[English abstract of article by Sun Goufan of the 609 Institute, Ministry of Aviation Industry; MS received 10 Sep 90]

[Text] The principles for designing a fly-by-wire control system are introduced. The effects of various structural parameters on aircraft behavior are discussed by means of semi-physical simulation tests and analysis. The approaches are pointed out for improving fly-by-wire control aircraft behavior.

Comparison Between Parameter Design and Test-Flight of Longitudinal FBW System

40100012C Xian FEIHANG LIXUE [FLIGHT DYNAMICS] in Chinese No 1, Mar 91 pp 65-71

[English abstract of article by Li Baolai of the 618 Research Institute, Ministry of Aeronautics and Astronautics Industry; MS received 25 Jun 89]

[Text] The flying qualities of aircraft with FBW FCS are determined by the varied parameters of the system. This paper deals with some problems which were put forward during the design and testing of the control system parameters, and the demonstration test-flight of flying qualities in CAS mode.

Domestic Development of Tactical Air-Defense Laser Weapons Described

92P60110A Beijing ZHONGGUO HANGTIAN [AEROSPACE CHINA] in Chinese No 12, Dec 91 pp 35-38, 42

[Article by Ji Shifan [6060 0013 5672] of the Beijing General Institute of Electronic Engineering: "Domestic, Foreign Development of Tactical Air-Defense Laser Weapons"]

[Excerpts] **Abstract**

Tactical missile defense as an important task in modern air defense and the tactical air-defense laser weapon as an effective weapon are described. The history and present conditions of laser weapons developed by the three U.S. services are also detailed, and R&D of laser weapons by the Soviet Union, Germany, France, and the People's Republic of China are briefly discussed. [passage omitted]

5. China

Led by the principle of "Emphasizing the foundations and emphasizing advances," China in its research on this topic has over a long period of time conducted a number of appropriate exploratory studies in high-power laser technology. In the area of high-power lasers, the nation has researched CO_2 lasers (electrically driven and air-operated), chemical lasers, FELs, X-ray lasers, etc. Of these, the output power of CO_2 lasers and chemical lasers has surpassed the 10 kW level. In research on the destructive effects of high-power lasers, China's scientists have achieved several satisfying results in relatively broad and deep experimental and theoretical studies on the thermal and mechanical effects of lasers, and have achieved a certain understanding of how high-power lasers can destroy a target. In studies on the atmospheric transmission characteristics of high-power lasers, they have done a number of broadly theoretical and experimental studies on atmospheric refraction, atmospheric attenuation, turbulent flow effects, nonlinear effects, and the like. They have also made progress in the application of adaptive optics technology to improve atmospheric transmission characteristics; using a transverse shearing interferometer as a wavefront detector to drive 21-element deformation reflector, they have studied 300-Hz-bandwidth compensation techniques for the atmospheric turbulent flow effects of laser beacon light beams. They have been able to raise corrected peak energy (intensity) to 3.5 times the uncorrected value, with a distribution approaching the diffraction limit.

In summary, China's scientists have laid a firm technical foundation in the area of high-power laser technology, and based on the demand can carry out high-level development work on tactical air-defense laser weapons. [passage omitted]

Trial Run for Interferon Treatment

40101010B Beijing CHINA DAILY (National) in English 9 Jan 92 p 3

[Text] Shenzhen (Xinhua)—Gene engineered interferon developed by Chinese scientists over the past 12 years will be put into trial production in Shenzhen in the near future.

The "Ren (Human) Alpha 1" and "Ren Alpha 2a" interferon are the first types of gene engineered medicines to receive a state license enabling their production.

Experts who participated in China's first forum on the clinical production of gene engineered interferon, which was held yesterday in Shenzhen, said the successful development of gene engineered interferon ranks China as one of the world's few countries able to produce high technology biological products.

The gene engineered interferon was jointly developed by the Institute of Virology of the Chinese Academy of Preventive Medicine, the Shanghai Research Institute of Biological Products and the Changchun Biological Engineering Research Institute.

Biotech Products Get a Boost

40101010A Beijing CHINA DAILY (Shanghai Focus) in English 2 Dec 91 p 1

[Article by Chen Qide]

[Text] The country's first comprehensive biotechnology centre has been built in Shanghai after five years' efforts.

Located in Caohejing Hi-Tech Park, the aim of the Shanghai Centre of Biotechnology is to help turn laboratory findings into practical production as soon as possible, said Zhang Shenbei, director of the centre.

The centre, with a construction area of more than 30,000 square metres, was one of China's largest projects during the Seventh 5-Year Plan period (1986-1990).

It is made up of an 8,000-square-metre research building, a 7,000-square-metre pilot plant, an animal testing facility, a workshop and a waste treatment system.

"The centre will act as a bridge between scientific research and industrial production," said Zhang.

Unlike other scientific institutes, it will combine research with production to find the best way to turn scientific discoveries into profit-making ventures.

Built at a cost of $12 million, the centre is equipped with advanced equipment from Germany and the United States.

At the end of last year, the centre started up trial operation of its pilot workshop, which can successfully research 20 biotechnology items simultaneously.

Biotechnology is one of the world's rising application sciences, which covers gene, microbe, cell and fermentation bioengineer. Scientists hope to use this type of work to find new solutions to problems such as hunger, disease, energy and pollution.

Because of its importance in promoting industry, agriculture and pharmaceutical production, biotechnological research has been conducted in many areas, with food and light industries the dominant projects.

Zhang said this practice has been carried out by many other countries, such as the United States which set up its first biotechnology company in 1976. According to statistics, the world biotechnology markets will have commodities worth about $100 billion by 2000.

Zhang said the centre will focus on gene research, and will also launch research into cell and enzyme technologies.

The director said currently the centre is making commercial negotiations with foreign companies over joint ventures.

The Chinese Academy of Sciences now has 26 biotechnology institutes with seven in Shanghai.

High-Temperature DNA Sequencing

92P60108A Shanghai WEN HUI BAO in Chinese 28 Nov 91 p 1

[Article by Wang Lin [3769 3829], New Technique to Break Genetic Codes]

[Summary] In November 1991, a group of scientists headed by Hong Guofan [3163 0948 5672] of the Shanghai Biochemical Institute of the Chinese Academy of Sciences, announced a new method, high-temperature DNA sequencing, to identify the gene pattern of DNA. The new technique can untie the secondary structures of DNA sequences and provide favorable conditions for enzymes and reagents to react at 65° C. This not only eliminate the 'accumulation effect' barrier in examination of DNA nucleotides but also solves the enzyme and reagent stability problem encountered in using automated sequencing methods. In contrast to conventional DNA sequencing techniques, in which enzymes and reagents are stable for only a few hours, enzymes and reagents can be stored in the new high-temperature DNA sequencing system for 2 weeks at 25° C without loss of biological activity. The new system has been widely used in China by many well-equipped laboratories and its sales are expected to hit 3 million dollars a year.

Experimental Studies on the Transmission of HFRS Virus by Gamasidea Mites and Fleas

40091007B Beijing ZHONGHUA YIXUE ZAZHI [NATIONAL MEDICAL JOURNAL OF CHINA] in Chinese Vol 71 No 9, Sep 91 pp 502-504

[English abstract of article by Dong Bijun [5516 1801 6511], Liu Zhiguang [05491 1807 1639], et al.; Institute of Epidemiology and Microbiology, Chinese Academy of Preventive Medicine]

[Text] Hemorrhagic fever with renal syndrome (HFRS) virus was isolated from three species of gamasidea mites (Haemolaelaps glasgowi, Laelaps jettmari, Eulaelaps shanghaiensis), and two species of fleas (Monopsyllus anisus, Leptopsylla segnis) collected from nests of HFRS virus-infected Apodemus agrarius, whereas HFRS virus was not recovered from Gamasidea mites and fleas collected from nests of uninfected Apodemus agrarius. It was thus confirmed that HFRS is a disease of animal origin with natural foci of infection.

Experimental studies demonstrated that positive results of virus isolation were obtained from originally healthy population of Monopsylla anisus, Leptopsylla segnis and Haemolaelaps glasgowi 24 similar to 48 hours after they had sucked HFRS virus suspension; while positive results of virus isolation were still obtained from Haemolaelaps glasgowi but not from two species of fleas seven days after they had sucked HFRS sirus suspension. It was confirmed that Monopsylla anisus and Leptopsylla segnis cannot propagate HFRS, and therefore their transmission would be mechanical. On the contrary, Haemolaelaps glasgowi might play the role of biological vector.

Purification of Fragment AB of Tetanus Toxin and Its Activity

40091007A Shanghai SHENGWUHUAXUE YU SHENGWUWULI [ACTA BIOCHIMICA et BIOPHYSICA SINICA] in Chinese Vol 23 No 5, Sep 91 pp 384-391

[English abstract of article by Lei Dianliang [7191 3013 5328], National Institute for the Control of Pharmaceutical and Biological Products, Beijing; and Morihiro Matsuda, Research Institute for Microbial Diseases, Osaka University, Japan.]

[Text] The tetanus toxin fragment AB was purified from papain digested toxin by high performance liquid chromatography, hydroxyapatite chromatography and affinity chromatography using anti-fragment C antibody as a ligand. The purified fragment AB was identified as a single protein band in PAGE and SDS-PAGE with a molecular weight of 98000. It was demonstrated that fragment AB was free from contaminated residual intact toxin by animal tests and immunoblotting. Fragment AB(200 µg) elicited a peculiar non-spastic toxicity of weakness in mice and the mice died in about 3 days. By the patch clamp technique, fragment AB formed ion channels in an asolectin lipid bilayer with a conductance of 8pS.

Sino-Japanese Joint Development of Intelligent Computer Networks Described

92P60122A Harbin HARBIN GONGYE DAXUE XUEBAO [JOURNAL OF HARBIN INSTITUTE OF TECHNOLOGY] in Chinese Vol 23 No 6, Dec 91 pp 52-57

[Article by Liu Wentao [0491 2429 3447] and Li Guiqin [2621 2710 3830] of the Harbin Institute of Technology Computer Department, Kenji Sugawara of Chiba Institute of Technology, and Shoichi Noguchi of Tohoku University, project supported by Natural Science Foundation of China grant No. 69043002: "New Trend in the Development of Computer Networks—Development of Intelligent Networks"; MS received 18 May 91]

[Excerpts] **Abstract**

A new direction in the development of computer networks—the development of intelligent networks (INs)—is described. Specifically, the international cooperative project undertaken by Chinese and Japanese scholars since 1983 in the joint development of IN standards—a high-tech environmental area—is described. Moreover, based on numerous academic interchanges and exchange of results between scholars on both sides, the IN development process and the development of basic concepts, definitions, classifications, system structure, and organizational structure—as well as future development prospects—are considered.

[Passage omitted]

In 1983, scholars from Japan's Tohoku University (Shoichi Noguchi, Mitsuro Oizumi, and Norio Shiratori) and Chiba Institute of Technology (Kenji Sugawara) and from Harbin Institute of Technology (Liu Wentao) began a Sino-Japanese cooperative project to develop an "intelligent computer information network system" (ICINS)-—usually shortened to "IN"—based on the computer information network (CIN). In the first phase of this cooperation, scholars from the two nations set about studying "New IN Design Methods" (a discussion of methods),[2] an "IN Development Support System" (development tools),[3] "IN Intelligent Man-Machine Interfaces"[4,6] and other topics, and conducted exploratory research in IN development. The research results from this initial work were published at three international computer conferences: ICCA-1 (1984), ICCA-2 (1987), and PPCC-3 (1989). In 1988, the two sides formally reached an "International Joint Research Agreement"—with an effective period of 5 years—for study of IN development. At present, according to the stipulated plans of the "agreement," scholars from both sides are successfully conducting research on development of IN node configurations—specifically, the "intelligent workstation" (IW).

Below, based on this international joint research—i.e., the principles of IN development worked out by the two nations—a discussion and exploration of relevant IN definitions, basic concepts, structural schemes, and future development prospects is given.

1. The Intelligent Network (IN)

This section recounts and explores IN basic concepts, definitions, categories, and their structural configuration schemes.

1.1 IN Basic Concepts, Definitions, and Categories[5]

Scholars and manufacturing groups from a number of countries, examining this issue from different points of view, now have a variety of opinions on IN mechanisms and definitions. For example, taking the computer communications network (CCN) as a basic IN, users and developers are quite interested in "intelligentizing" network communications, such as with expert systems for automatically detecting and correcting CCN faults, or for flow control and optimized path selection. In short, within the CCN one needs in various degrees to implement "intelligentized" operation (intelligent network operation, maintenance, and management) in order to correctly understand and define the IN. In another sense, taking the CIN as a basic IN, users and developers are stressing high-level information processing, optimized real-time control, management systems, and optimized decision support for military command systems. In other words, in understanding and defining the IN, they emphasize "intelligentized" services provided to the user. Strictly speaking, however, the IN concept implies more than requiring a networked system to have functions such as resource sharing, distributed information processing, and load equalization, it more significantly means the ability to implement such "intelligentized" operation and "intelligentized" services within the computer network.

The current world state of IN development may be summarized by considering the following two general types: IN type A, which consists of "intelligentizing" existing networks, and IN type B, which consists of linking new-generation computers (fifth- or sixth-generation computers) into a network.

Since the new-generation computers are intelligent machines which when networked can provide the user friendly service functions of "intelligentized" operation and "intelligentized" services, they naturally form an IN. However, since the new-generation computers are still in development, scholars, manufacturers and network researchers worldwide have mostly devoted their efforts to development of the type-A IN. Because development of a support environment (with either the CCN or the CIN as a basis) and provision of user friendly required services (whether emphasizing "intelligentized" operation, or "intelligentized" services, or both simultaneously) are not the same, IN type A may be divided into the following two subtypes: subtype No. 1, an IN formed from IWs, hereafter called the type-A_1 IN, and subtype No. 2, an IN consisting of a network whose system structure has been "intelligentized," hereafter called the type-A_2 IN.

The type-A_1 IN, based on the CIN, revolutionizes the network node configuration, which is to say that it assimilates fifth-generation computing's advanced structural characteristics (integration of inference engines and knowledge base (KB) systems), borrows from the field of artificial intelligence relevant technologies (such as distributed KBs and expert systems), and via IW networking becomes an IN capable of simultaneously providing "intelligentized" operation and "intelligentized" services. The Sino-Japanese international cooperation consists of R&D of the ICINS, which belongs to the type-A_1 IN. Essentially, it is an internetworked new-generation computer "simulation IN"; i.e., development of the ICINS will contribute to the realization of intelligent networking for new-generation computers.

The type-A_2 IN, based on the CCN, signifies "intelligentization" of the system structure in existing networks. In other words, under the support of the OSI [open systems interconnection] environment, it implies the "intelligentized" development of the standardized seven-layer protocol; or, it implies the introduction of expert systems in the various network loops in order to provide the required "intelligentized" operation. Examples are IN/1, IN/2, and Net1000, developed by the U.S. firm AT&T for telecommunications network (TCN) purposes; these three networks all fall within the type-A_2 IN range.

Since there is ample documentation of type-A_2 INs, the present paper focuses on introduction of the type-A_1 IN, i.e., a recounting and exploration of the ICINS network structure, system structure, and related matters.

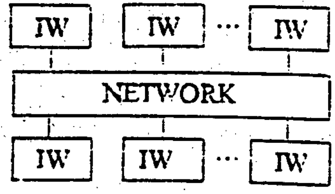


Figure 1. Network Structure of ICINS

1.2 The ICINS Network Structure and System Structure

The ICINS, a type-A_1 IN, besides having distributed network processing and intra-network resource sharing functions, has an "intelligentized" network structure and system structure, and therefore provides simultaneous "intelligentized" operation and "intelligentized" services.

1.2.1 The ICINS Network Structure[8]

The ICINS is an IN formed from the internetworking of various users' IWs, and has a network structure shown schematically in Figure 1.

In the ICINS schematic, NETWORK is the structural entity of the ICINS physical layer; its main target is the CIN, namely a LAN or other internetworked system. Since the IW has open characteristics, it can be linked up with a broadband integrated services digital network (B-ISDN) or other wide-area network (WAN) to form an IN. Following upon the continued "intelligentization" and perfection of the ICINS, the IW can replace various user resource sub-networks and when integrated with a CIN's communications sub-networks (as shown in Figure 1) can form a "simulation IN" for a new-generation-computer network (B-type IN).

The IW comprises the ICINS's core, whose logic structure is shown in Figure 2.

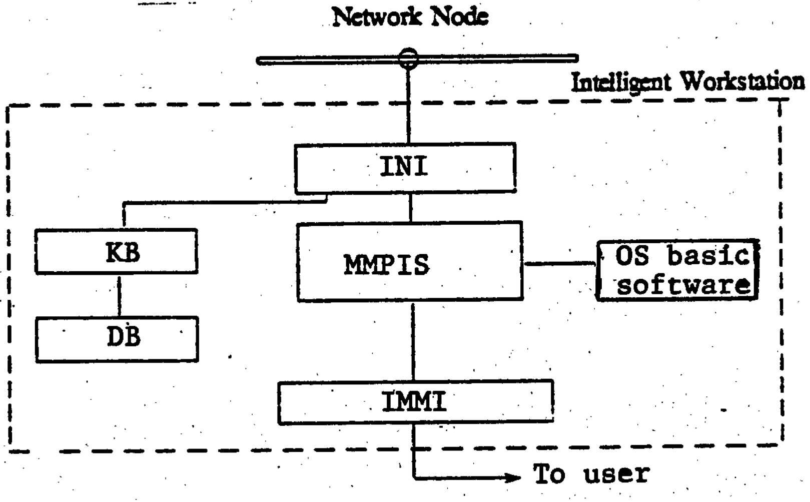


Figure 2. Logical Structure of IW

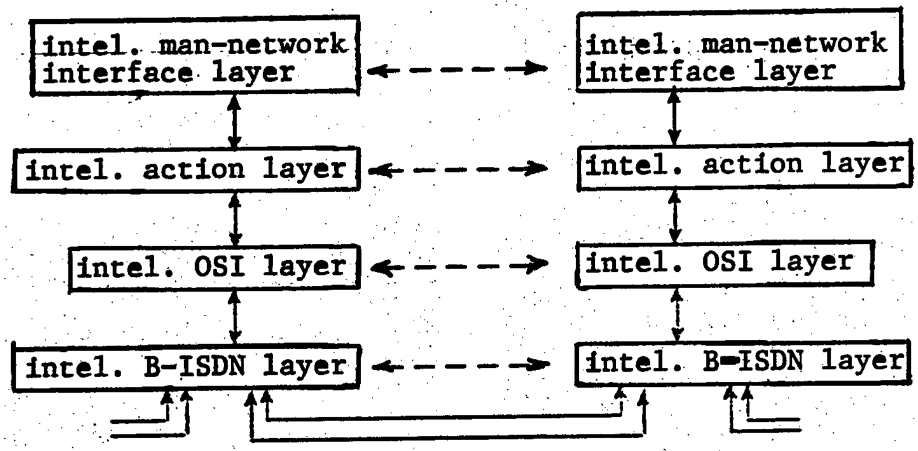


Figure 3. Reference Model of ICINS Architecture

In Figure 2, the IMMI is the intelligent man-machine interface, directly oriented toward the user; it supports natural language understanding, speech recognition, graphics recognition, character recognition, user task requirements recognition, and man-network information interchange, and provides the user with various intelligentized high-level information (such as heuristic knowledge and intelligentized decision-support information). The multi-microcomputer parallel inference system, or MMPIS, is the IW's inference mechanism, and is the user's high-level information processing system. MMPIS is a tightly coupled distributed processing system formed from several microcomputers, is under the support of the OS [operating system] basic software, and integrated with the KB and database (DB) provides the "intelligentized" operation and "intelligentized" services functions. The intelligent network interface, or INI, is the "intelligentized" interface between the IWs and the CIN communications sub-networks. The INI supports link-up of the IWs and various types of networks, and simultaneously supports the link-up between the KB and the MMPIS.

1.2.2 The ICINS System Structure[7,8]

Since the ICINS is comprised of "intelligentized" resource sub-networks (see the multi-IW system shown in Figure 1) and CIN or similar network or their communications sub-networks, and considering the ISO's standardized recommendations and current international internetworking, the ICINS system structure must be built upon existing network system structures and ISDN system structures. In other words, based on ISO7498 (OSI) and CCITT/I.120 (ISDN), one introduces artificial intelligence technology to provide an intelligent action layer [zhineng daili ceng; similar to the presentation layer of the OSI Reference Model] and intelligent man-network interface layer. Therefore, the ICINS system structure must be a four-level structure (as shown in Figure 3), with each level working under the distributed artificial intelligence and distributed KB support generated in the multi-IW system.

In the ICINS system structure Reference Model, the functions of each layer are:

(1) The intelligent man-network interface layer supports natural language interchange and understanding;

(2) The intelligent action layer provides high-level information processing and service functions;

(3) The intelligent OSI layer implements "intelligentization" in all OSI layers and network management;

(4) The intelligent B-ISDN layer provides high-speed, high-efficiency transmission functions for multimedia.

Since the ICINS has the aforementioned advanced network structure and "intelligentized" system structure, it can provide users with the necessary expert systems and distributed KBs. Therefore, the ICINS is highly advanced, i.e., able to provide the user with "intelligentized" high-level services; is open, i.e., can support link-up among dissimilar networks; and is adaptive, able to provide a high degree of automation in network operation and management services such as deadlock debugging, conflict resolution, fault diagnosis, recovery, and overload regulation. In addition, it also is customizable, i.e., via a heuristic KB it can provide various dynamic compounds and a real-time scissors, to satisfy the user's needs in processing of various kinds of randomly changing high-level information.

2. Future Prospects for the IN[8]

Based on the discussion given in the preceding two sections, it is not difficult to advance the following points with regard to future development prospects:

(1) Since information applications are continually expanding and high-level information requirements

multiplying, with users making increasingly higher demands for high-level services and user-friendly interfaces, all of us are forced to hasten and deepen the "intelligentization" of existing networks. The emergence and growth of INs is a new direction in the development of computer networks; it is an inexorable trend in the development and renovation of existing networks.

(2) Comparing the type-A_1 IN (or ICINS) with the type-A_2 IN, one can see that the type-A_2 IN is only a transitional type of IN; from a long-term point of view, the orientation of "intelligentizing" existing networks fully lies in the development of the type-A_1 IN.

(3) The type-A_1 IN essentially is a "simulation IN" for the B-type IN (intelligently interlinked new-generation computers), and therefore it is functionally equivalent to the B-type IN; it provides experience and technical knowledge for the construction of a B-type IN.

(4) From a long-term point of view, once the B-type IN is built and enters a functional stage, existing networks will fall into disuse, but the type-A_1 IN will still exist simultaneously with it; the full utilization of existing-network resources and third- and fourth-generation computers for extended active duty can create excellent conditions.

(5) Following upon the continued development and improvement of the type-A_1 IN, under the support of "intelligentized" resource sub-networks made from multiuser IWs (a colony IW system), one can within the type-A_1 IN form "colony expert systems" for handling all kinds of user demands, enhancing even more the functions of the type-A_1 IN.

(6) Following upon the continued improvement of the IN (especially the OSI systems, which have excellent open characteristics), one will be able to make the IN system structure even simpler and more advanced.

References

1. Liu Wentao et al., "On the Design and Analysis of Interconnection System of LAN for Large-Scale Enterprises OA and FA," PPCC-3, Beijing, 1989.

2. Liu Wentao et al., "A New Design Method of Computer Networks," The 1st ICCA, Beijing, 1984.

3. Kinoshita, T., et al., "Knowledge-Based Design Support System for Computer Communications System," IEEE JOURNAL ON SELECTED AREAS IN COMMUNICATIONS, 1988, 6 (5).

4. Liu Wentao et al., "A Description Method for User Requirements Specification of Distributed Information Processing Systems," NCR, Japan, 1984.

5. Ae, T., et al., "Intelligent Network System DRAON," Information Processing Society of Japan, 1983.

6. Sugawara, K., et al., "A Consideration on and User Interface of Computer Network System," The 2nd ICCA, Beijing, 1987.

7. Shiratori, N., et al., "An Intelligent Support System for Developing Communication Software in Computer Networks," The 2nd ICCA, Beijing, 1987.

8. Liu Wentao et al., "Configuration of Nodes on the Intelligent Network—The Development of the Intelligent Workstation," ICCC'91, Beijing, 1991.

Superiority of Digital Neural Networks

92P60106A Beijing JISUANJI YANJIU YU FAZHAN [COMPUTER RESEARCH AND DEVELOPMENT] in Chinese Vol 28 No 5, May 91 pp 8-12

[Article by Chen Songcan [7115 2646 3503], Yang Guoqing [2799 0948 1987], and Xu Tao [1776 3447] of the Department of Computer Science & Engineering, Nanjing Aeronautical Institute, Nanjing 210016: "The Superiority of Digital Neural Networks"; MS received Jun 90]

[Abstract] First, the characteristics and limitations of neural networks based on the standard McCulloch-Pitts (M-P) neuron model are discussed. Next, following upon the concept advanced by the British expert Aleksander[3] for using RAMs to implement logic neural elements, a probabilistic logic neural-element node (PLN) model, shown schematically in Figure 2 [Figure 1, depicting the basic M-P model, is not reproduced], is proposed. The PLN model is then incorporated into a novel probabilistic logic neural network (PLNN) implemented with digital memory devices such as RAMs; a single-layer learning example for this network is shown schematically in Figure 3. PLNN can be characterized by a five-component description, KCAFT, where K is the PLN node set, C is the number of node connections, A is the binary unordered set 0,1, F is the function set for network operation, and T is the learning technique. The

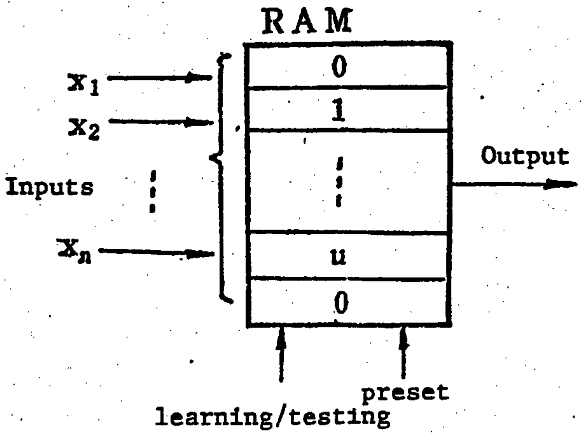
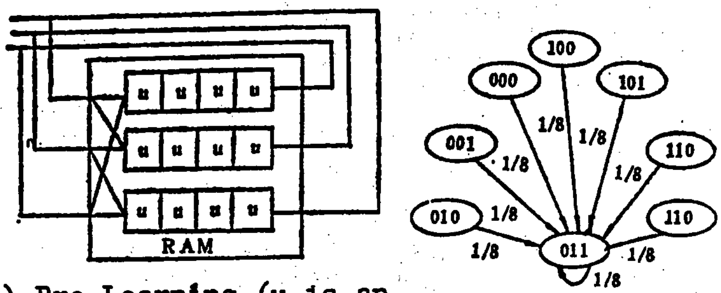
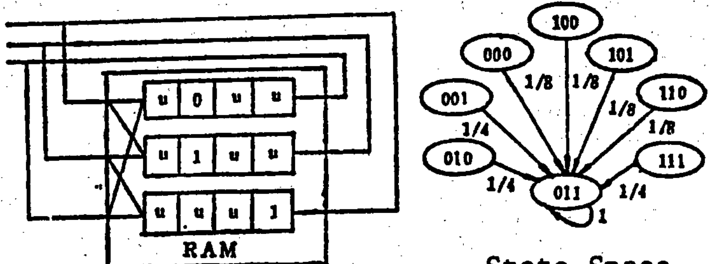


Figure 2. PLN Model; u is an unspecified value


u u u u
u u u u
u u u u
RAM
100
000
101
001
110
010
110
011
1/8
1/8
1/8
1/8
1/8
1/8
1/8
1/8
1/8

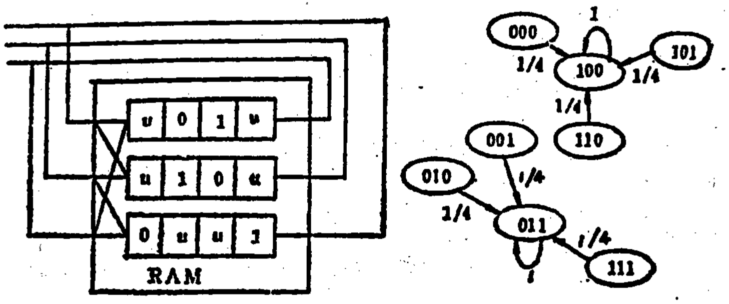
(a) Pre-Learning (u is an unspecified value)

State Space


u 0 u u
u 1 u u
u u u 1
RAM
100
000
101
001
110
010
111
011
1/8
1/8
1/8
1/4
1/8
1/4
1/4
1

State Space

(b) Path from Learning Mode 011


u 0 1 u
u 1 0 u
0 u u 1
RAM
1
000
100
101
1/4
1/4
1/4
110
001
010
1/4
1/4
011
1/4
111
1

(c) Path from Learning Mode 100

State Space

Figure 3. Learning Example for a Single-Layer PLNN

simplicity of the PLNN learning algorithms and hardware implementation—compared to those for an M-P-based neural network—are emphasized. Finally, the advantages of the PLNN in developing sixth-generation computers such as connectionist machines with inference capability are discussed.

References

[1] McCulloch, W.S. and Pitts, W., "A Logical Calculus of the Ideas Immanent in Nervous Activity," BULLETIN OF MATHEMATICAL BIOPHYSICS, Vol 5, 1943, pp 115-133.

[2] Hinton, G.E., "Distributed Representation," Technical Report CMU-CS-84- 157, Department of Computer Science, Carnegie-Mellon Univ., Oct. 1984.

[3] Aleksander, I., et al., "WISARD: A Radical Step Forward in Image Recognition," SENIOR REVIEW, July 1984, pp 120-124.

[4] Rumelhart, D.E., et al., "Learning Internal Representation by Error Propagation," in PDP, Vol I: Foundations, MIT Press, 1986.

[5] Hinton, G.E., et al., "Boltzmann Machines: Constraint Satisfaction Networks that Learn," Tech. Rep. CMU-CS-84-119, 1984.

[6] Hopfield, J.J. and Tank, D.W., "Neural Computation of Decisions in Optimization Problems," BIOLOGICAL CYBERNETICS (52), 1985, pp 141-152.

New Joint Ventures With Japanese, Australian, U.S. Firms Announced

Sino-Japanese Shanghai Sodick Software Ltd.

92P60092A Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 46, 27 Nov 91 p 1

[Article by Wen Yi [2429 6318]: "Sino-Japanese Joint Venture Shanghai Sodick Software Co. Opens for Business"]

[Text] Shanghai Sodick [Sha-di-ke 3097 6611 0344] Software Ltd., a joint venture between the Shanghai Tonghua [6639 5478] Computer Software Plant and Japan's Sodick Co. (the world's largest maker of electric-discharge machining equipment) is now open for business. Capitalized with a gross investment of US$1.3 million, the new joint venture will mainly develop applications software for a variety of the Japan Sodick Co.'s brand-name products in the computer-controlled electric-discharge machining equipment area, as well as computer numerical control (CNC) software. All of the products will be sold in Japan.

Sino-Australian Injection-Mold CAE Co.

92P60092B Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 46, 27 Nov 91 p 2

[Article by Liu Wenhui [0491 2429 0565]: "Australian Software Firm To Transfer Technology to China"]

[Summary] On 11 November, the Australian software technology firm (Mo-er-de-fe-lu) [5459 1422 1795 1715 5684] Ltd. and the China Light Industry Mold Technology Development Center signed a memorandum of agreement to form a joint venture. Each side will put up 50 percent of the funds to build the joint-venture facility in Beijing. The new joint venture will develop and market computer-aided engineering (CAE) technology for the injection mold industry. The new products will be developed with the aid of the Australian firm's software for simulating injection-mold processes, and will be used to design and manufacture molded parts.

Sino-U.S. Digital Systems Co.

92P60092C Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 46, 27 Nov 91 p 3

[Unattributed article: "Chinese Contribute Technology, U.S. Contributes Funds: Beijing Fricom Digital Systems Co. Opens for Business"]

[Summary] The Sino-U.S. joint venture Beijing (Fu-lan-ka) [1715 5663 0595] Digital Systems Ltd. (Fricom) formally opened for business a few days ago. This new joint venture, established by the Zhongruan Computer Institute, located in Beijing Municipality's Haidian [New High-Tech Development] Zone, and the U.S. firm Timsons [Xingsheng 2502 4141] Co., will draw upon the digital signal processing (DSP) software expertise of Zhongruan and the financial assets of Timsons. The new DSP products will be marketed internationally by the U.S. firm. Timsons has already built two electronics plants in Shanghai for manufacturing semiconductor diodes and other products.

Sino-U.S. Software Development Co.

92P60099C Beijing KEJI RIBAO [SCIENCE AND TECHNOLOGY DAILY] in Chinese 11 Dec 91 p 2

[Article by Jia Xiaohui [6328 2556 1979]: "Stone [Group] and U.S. Software Co. To Cooperatively Develop Computer Software"]

[Text] After the Chinese government promulgated the "Computer Software Protection Regulations," the U.S. firm Digital Research, an internationally known software manufacturer, completed negotiations with the Stone Group to cooperatively develop China's computer software market. Stone Group this year established a Software Engineering Enterprise division for domestic and foreign software and software-systems consultation, servicing, development, and sales. The new joint project with Digital Research will concentrate on resolving problems with Chinese DOS, including consistency, differences in compatibility, slow speed, and large usage of resources.

More on Stone Group-Digital Research Cooperation

92P60113D Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 50, 25 Dec 91 p 1

[Article by Xuan Gang [1357 0474]: "Stone Group, U.S. DR Co. Jointly Develop Software Market"]

[Summary] The agreement recently reached between the Beijing Stone Group and the U.S. firm Digital Research (DR) is oriented toward developing the domestic software market. Specifically, Stone Group will develop a Sinicized [i.e., Chinese-language] version of DR's newest systems software product, the DR DOS6.0 single-user operating system, and will become DR's representative in China. The Sinicized DR DOS6.0 will formally come out next year [i.e., 1992]. DR DOS has had phenomenal success, with over 5 million licensed copies sold on the world market. At the joint press conference to announce the formal cooperation, DR representatives indicated several advantages of DR DOS6.0 over its competitor MS DOS5.0.

Nine GW Systems Support Software Products Commercialized

92P60113A Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 49, 18 Dec 91 p 1

[Article by Zhang An [1728 1344]: "Great Wall Group Commercializes Nine Systems Support Software Products"]

[Summary] Nine commercialized computer systems support software products developed by China Great Wall (GW) Computer Group were unveiled on 10 December in Beijing, and will be on the domestic and foreign markets by early next year [i.e., 1992]. These new products, the first group of copyrighted mainframe systems support software products to be produced domestically since the promulgation of the computer software protection regulations, include a multimedia relational database (GW-Tide), data list software (GW-EasyCalc), the GW-CVGA/24 Chinese system, simulation software (GW560pc), graphics windows system Chinese-character environment software (GW-CXTool and GW-CWinTool), Great Wall tree network software (GW-TreeNet1.0), general-purpose computer data proofing software (GW-CDI1.0), and line discipline analysis software (GW-LPA1.0). These new products, compatible with similar foreign software packages, are intended for scientific calculation, data processing, business management, office automation, CAD, and similar purposes.

State Invests 150 Million RMB in Expansion of GW's Production Base

92P60113B Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 49, 18 Dec 91 p 1

[Article by Liu Jiuru [0491 0046 1172]: "State Invests 150 Million Yuan in Expansion of Production Base: Another 'Great Wall' Is Built"]

[Summary] It was recently learned that the state has made a decision to invest 150 million RMB to expand the production facilities of China Great Wall (GW) Computer Group. GW's Shenzhen Co. Assistant General Manager Qian Lejun told this reporter that the Shenzhen Science Park facilities expansion, one of the 10 major CHINATRON Corp. projects on which construction is being moved up, will begin early next year [i.e., 1992], will be completed by the end of 1993, and will be formally put into production in 1994. The expansion includes a renovated product development environment, improved quality control equipment, and enlargement of production scale. It is estimated that the firm's post-expansion annual output value could reach 2 billion RMB, with 75 percent of the products sold abroad.

Ergo 3.5-Inch Floppy Disk Drive on International Market

92P60099A Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 47, 4 Dec 91 p 1

[Article by Han Yun [7281 0061]: "Ergo 3.5-Inch Floppy Disk Drive Gains a Firm Foothold on International Market"]

[Summary] As of November, the Sino-Hong Kong [joint venture] Ergo Computer International Ltd. had distributed 120,000 of its Ergo 3.5-inch floppy disk drives (FDD)—quantities of which were first put on the market in May 1991—to European, U.S., Canadian, Australian, and Southeast Asian customers. In so doing, Ergo becomes the first non-Japanese producer able to supply these FDDs in mass quantities. This year's [i.e., 1991] global output of 3.5-inch FDDs is projected to be about 36 million, of which 99.9 percent are Japanese made. The magnetic heads and ASICs for the Ergo 3.5-inch FDD have been independently designed by Hong Kong and mainland engineers, and are manufactured at a Japanese plant. Except for the stepper motor, main axis motor, and a few other key components which must be imported, most of the rest of this FDD is domestically made. So far, the 3.5-inch FDDs sold to U.S., German, Canadian, and other customers have been 2MB units, monthly production of which is now 30,000; 4MB units will be made beginning in early 1992, and 8MB and 20MB units are now in development.

New Anti-Virus Card Has Three Functions

92P60113C Beijing ZHONGGUO DIANZI BAO [CHINA ELECTRONICS NEWS] in Chinese 18 Dec 91 p 1

[Article by Wang Xuewu [3769 1331 2976]: " 'Ruixing' Anti-Virus Card Has Three Functions"]

[Summary] Beijing Ruixing [3843 2502] Computer S&T Development Co. recently perfected and marketed a new anti-virus card with three functions: it detects viruses hidden in files, effectively eliminates RAM-resident viruses, and permits safe execution of routines bearing viruses. The new card works on boot-sector viruses, file-type viruses, RAM-resident viruses, and on viruses hidden in software programs. Experts have commented that this new card, which overcomes certain deficiencies in previous-generation domestically developed anti-virus cards, is the functionally strongest anti-virus card to be made here so far. The Ruixing card runs under various network environments and windows environments.

CHINATRON Corp. To Promote CAD/CAM R&D Throughout Nation

92P60113E Beijing ZHONGGUO DIANZI BAO [CHINA ELECTRONICS NEWS] in Chinese 25 Dec 91 p 1

[Article by Zheng Genling [6774 2704 1545]: "CHINATRON Corp. To Adopt Strategic Measures for CAD/CAM Development"]

[Summary] During the Eighth 5-Year Plan, CHINATRON Corp. will adopt a number of strategic measures for accelerating CAD/CAM research and development, promoting CAD/CAM applications, and fostering the nation's indigenous CAD/CAM industry. This was learned from a recently held major CHINATRON conference on promotion of CAD/CAM applications. The three main tasks decided upon at the conference are: vigorous promotion of applications of CAD/CAM technology, with the goal of requiring all research and production units within the corporation to fully utilize CAD programs at a mid-eighties international level by the end of the Eighth 5-Year Plan; development of a coordinated CAD/CAM industry able to absorb advanced imported technology, to furnish domestically made CAD/CAM software and hardware systems to all Chinese industries, and to capture a certain share of the world CAD/CAM market; and improved training in CAD/CAM skills via establishment of a national CAD/CAM training network, with a goal of requiring all engineering design and product R&D personnel to have a basic knowledge of CAD/CAM principles and a mastery of CAD/CAM applications by the end of the plan. To achieve these goals, the conference attendees adopted five specific strategic measures, including formation of a leading group for promoting development and applications of CAD/CAM technology, establishment of demonstration service centers, implementation of an assets inclination policy favorable to the development and applications of CAD/CAM technology, initiation of sales, service, and training programs, and active encouragement of Chinese participation in international exchanges and in joint ventures.

Full Chinese-Language Documentation for UNIX V5.4 To Be Published

92P60099B Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 48, 11 Dec 91 p 1

[Article by Hai Ping [3189 5493] and Han Yun [7281 0061]: "China To Publish Complete Chinese Documentation for UNIX"]

[Summary] It has been learned from authorities that China will publish and distribute a complete set of Chinese-language documents for the UNIX operating system V5.4, the latest UNIX release. Chinese officials have been working on the project with officials of the U.S. firm AT&T (the developer of UNIX) and of the Hong Kong firm DASCOM Co. (AT&T's representative). Over 100 Chinese software experts will work on the translation of the 49 documents (over 20 million characters) into Chinese. The project is being supported by a grant of almost US$1 million from the DASCOM Co. The documentation will be printed and distributed to users in China, Southeast Asia and other areas by the China Electronics Industry Publishing House, and is intended to promote development of Chinese software technology and the Chinese software industry. It is the first time such a huge set of computer documents have been translated into Chinese.

Update on Eighth 5-Year Plan Computer Industry/ Applications Targets

92FE0206A Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 46, 27 Nov 91 p 1

[Article by Xiao Yan [2556 3601]: "Focusing on Applications to Contribute to the Reform of Traditional Industry"]

[Text] As the "meeting for experience exchange and policy discussion on computer applications in traditional industry reform" and the "1991 Exhibit of Computer Products" are being held, the top official at the Office of Computer Industry at the Ministry of Machine Building and Electronics Industry accepted an interview by this paper. He answered several questions concerning the key objectives and targets of the computer industry in the Eighth 5-Year Plan.

In the Seventh 5-Year Plan, in order to meet the needs to reform the traditional industries using computers, China's computer industry made aggressive adjustments in philosophy, industry structure and product structure to allow the computer industry to grow in a rational manner. Computer applications have escalated to a new plateau in terms of both depth and breadth. Tens of thousands of computer applications have penetrated at various degrees into every aspect of the economy.

In the Eighth 5-Year Plan, China's computer industry will focus on applications and aggressively contribute to the reform of the traditional industry. The basic key objectives and targets in the Eighth 5-Year Plan are to take full advantage of the framework developed in the Seventh 5-Year Plan to address both the domestic and international market. We will emphasize key applications and points to establish a solid and sizeable computer industry which can capture a majority of the domestic market and can also compete in the international market. We will concentrate on system engineering to make sure that the products are compatible as a system. The level of application should also be improved. The real basic key objective is to establish large scale economic production capability.

The major tasks for computer applications in the Eighth 5-Year Plan are: (1) to provide computer-based products for real-time process monitoring and control for the building material, energy, electric power, metallurgy, petrochemical and electrical machine building industry and to upgrade various industrial boilers and furnaces. In the Eighth 5-Year Plan, the objective is to complete 10 percent of the reform and save 4 percent energy in order to meet the target of conserving at least 40 million tons of coal per year. (2) We plan to aggressively promote CAD and support everyone who uses CAD to meet the basic requirement. We should establish our own CAD industry as soon as possible (including reaching a capacity to build 3,000 engineering workstations and 5,000 ordinary workstations per year), producing a variety of peripheral equipment, developing our own copyrighted support software and classical CAD applications software and CAD/CAM systems for the electronics, molding and construction industry. (3) We should dedicate our effort to improving the management skill of large and medium government-owned businesses. In the Eighth 5-Year Plan, MIS (management information system) will be used in 1,000 key businesses in the electrical machine building industry. (4) We will develop a number of new products by integrating computer technology into electrical machines in order to upgrade the products and to make them compatible with other computer systems. (5) We will provide various computer products and software to serve the construction of 12 key national information management systems. (6) We will also provide general and dedicated computer products and applications systems for business, defense, education, health and daily needs of individuals.

The computer industry is facing a tough situation because it carries a great deal of responsibility and must overcome some hard technical hurdles. Special administrative policy must be adopted and forceful measures must be taken to keep it up with the needs of society. As a leader of the industry, we plan to do the following:

1. To provide incentives in order to encourage investment and to provide the climate for the computer industry to grow.

2. To continue adjusting industry structure and product structure, and to strengthen the construction of bases for research and development, manufacturing and export.

3. To expand economic cooperation and exchange with other countries.

4. To encourage export in order to provide the necessary condition to enter foreign markets.

5. To emphasize training and hiring talented people to build up the technical team.

6. To strengthen business management.

Status of Domestic CAD Technology Described

92FE0206B Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 46, 27 Nov 91 p 1

[Article by Tang Zhaoqun [0781 0340 5028]: "Status of Domestic CAD Technology Described"]

[Text] China began to engage in the research and application of CAD in the early 1970's. Back then, only a few industries (such as electrical machine building, aerospace and ship building) and a number of higher learning institutions (such as Qinghua University, Zhejiang University, Fudan University and Beijing Institute of Aeronautics and Astronautics) participated. The primary contents were mathematical theory of computer geometry, engineering drawing and layout, and circuit layout scheme. The main applications were limited to ship layout, aircraft design, and integrated circuit design. From the standpoint of the scope of research, range of applications and size of the team, it was in its infancy. However, after over a decade of hard work, CAD technology has been widely applied in large scale in the electrical machine building, aerospace, engineering design, ship building, light manufacturing and textile industries. Abundant results were obtained in research, development, applications, construction of bases and training. Furthermore, the Chinese Academy of Sciences, the State Education Commission and all ministry- and commission-affiliated higher learning institutions have contributed a great deal toward the development of CAD technology in China.

CAD applications have a good start and the effectiveness is becoming more apparent.

1. The effectiveness of CAD technology in the electrical machine building industry is apparent.

Since the Seventh 5-Year Plan, it entered an organized and planned phase. Several CAD projects developed are used in the design of mechanical products. The design efficiency is improved and the probability of success with a single path is raised. The product performance is improved. This strengthens the competitiveness of our mechanical products in domestic and foreign market. For example, the CAD system developed can shorten the product development cycle by ⅓ to 1/2, improve efficiency by 5 fold and raise one time success rate to over 90 percent. The direct economic benefit of the 12 CAD systems in automobile, agricultural machinery and heavy machinery is 100 million yuan. As another example, Shenyang Transformer Company successfully designed a transformer (220 kVA, 240 MUA) with CAD. It can reduce load loss by 150 KW. Every year, it saves 330,000 kWh of electricity. It also saves 3 percent of material. Harbin Institute of Power Plant Equipment used a hydropower equipment pricing system and a preliminary turbine design system, both developed in house, to provide an accurate and timely bid and won a $4,280,000 contract in the Philippines. As for CAD applications in mechanical products, up to the end of 1991, 12 CAD systems for mechanical products have been totally or partially transferred to 294 users. These software packages are being used by 86 plants and a total of 385 new products have been designed. 14 prototype machines have been built and 115 machines are in production.

Because of improved technical performance, higher efficiency, reduced energy consumption, and longer useful life of the mechanical products designed, CAD systems are expected to yield several billion yuan of social and environmental benefits.

2. CAD technology is widely used in engineering design and results in substantial economic benefit.

In the past 5 years, the CAD equipment in the Institute of Engineering Design has made significant improvement. There are more than 1,000 CAD workstations and over 10,000 microcomputer-based CAD workstations to raise the efficiency by 3 to 10 fold and to save basic construction capital by 2 percent. In the Seventh 5-Year Plan, it saved engineering investment by approximately 2 billion yuans. Currently, more than 90 percent of the computing, 50 percent of the design and 25 percent of the drawings are done by CAD in large design institutes in China. In industries such as electric power, petrochemical and petroleum, their design institutes basically have the technical ability to complete the entire exploratory design process with CAD. In the design of highways and railroads, route selection and cross section design can be completed by combining aerial remote sensing with CAD. It is possible to accurately and objectively choose a plan which has the lowest construction cost and the most economic shipping cost. In the design of the 240 meter dam at Ertan Power Plant, the type of dam was determined by CAD. Compared to the original design, it saved 2.14 million cubic meters of dirt, 1.56 million cubic meters of concrete and 56,000 tons of steel. Relative to the original estimate, it saved 478 million yuan and one year of construction time.

3. Aerospace industry has made significant progress in the application of CAD technology.

The aerospace industry has developed several large software systems and a number of software packages. In practice, CAD has accelerated product development and advanced technology. For example, an aircraft manufacturer used a CAD/CAM software it developed in house to develop new products. A computer model construction method is used to replace the conventional method to shorten the development cycle and to solve the machining problem of three dimensional curved surface involving five axes. This improved the efficiency by 2 - 4 fold. In the Seventh 5-Year Plan, efforts were made to develop integrated systems from individual software. The scope was expanded from model change to developing an entirely new aircraft. This technology was used in the development of several airplanes such as Yun-7 200B passenger jet. Many key institutions treated CAD/CAM as a key to technology reform. They obtained a number of subcontracts from foreign aircraft companies and the results were impressive. A number of accomplishments were made by applying CAD to the military. For example, Nanqi (Southern Automobile) used it to complete body design and model construction. This item alone saved 3.5 million dollars in hard currency.

CAD technology has been very effective in astronautical industry. Based on statistics gathered by the authority, most product structures are designed by CAD systems. On average, 5 - 20 percent of the analysis is done by CAD. The quality of design is improved and the development cycle is shortened.

4. The ship building industry began applying CAD technology in the early 1970's.

One of the important factors for the successful construction of ships for export in the Seventh 5-Year Plan is to use CAD technology as a powerful tool to compete in the world market. CAD technology has used in some scale in the ship building industry. From quotation to completion and delivery, CAD has been used to various degrees at key shipyards. 13 applications software packages have been distributed to over 30 organizations and the results are very good. Since 1987, Fudong (Eastern Shanghai) Shipyard conducted negotiations on over 100 ships with foreign merchants. It used its CAD system to provide quotation which significantly improved the success rate. Compared to 1985, export in 1985 grew by over 200 million yuan. Jiangnan Shipyard has used the onboard conduit integrated manufacturing system to design over 70 vessels. The design cycle is shortened by 2.5 months for each vessel.

5. Light manufacturing industry drastically reduced product development cycle by using CAD technology.

Apparel CAD systems have been put together in China and they are being used in the design of western style suits and shirts. The primary function is close to that of the CAD systems developed by Gerber (?) Corporation in the U.S. and Like (?) Corporation in France. In addition, a number of applications CAD systems have been developed for shoe trees, shoe uppers, computer-based embroidery, textile structure, pattern design, pattern printing and color matching.

Abundant accomplishments were obtained in the Seventh 5-Year Plan.

In the Seventh 5-Year Plan, under the arrangement of the government, production units and research and higher learning institutions worked hard on key issues in CAD technology. The end results is that we have accomplished a great deal in all areas, including hardware, support software and applications software.

1. Microcomputer workstation and engineering workstation are in low volume production.

In the Seventh 5-Year Plan, we successfully developed microcomputer and engineering workstations and put them into low volume production. Other engineering stations (such as Huasheng 3000 and Huasheng 4000) were also developed and we have the capability to produce them in low volume. This provides an excellent environment for the development of CAD technology in China.

2. CAD support software was successfully developed.

In the Seventh 5-Year Plan, a CAD support software system with specific reference to mechanical products was successfully developed. Its features include two-dimensional drawings, three-dimensional drawing, analysis and computation, and digital control coding database formation. It runs on either a microcomputer-based or an engineering workstation. This is a copyrighted CAD support software independently developed in China.

Presently, this software has not been perfected to be commercialized. Nevertheless, it is a good foundation for domestically developed CAD support software.

3. A large number of CAD applications software packages were developed.

In the Seventh 5-Year Plan, with the support of the government, a large number of CAD applications software packages for a variety of industries were developed by production units and research and higher learning institutions.

The machine building industry alone chose to develop CAD applications systems for 24 key products (including automobile, agricultural machinery, heavy machinery, machine tool, power generator, etc.) out of 52 key technical projects. The development and use of these systems pushed the technology of the entire machine building industry forward. It opened the ways for a bright future for mechanical CAD applications. In addition, we also developed a common database and a data acquisition database for mechanical products (including data bases for material property, fatigue strength, frictional erosion, etc.) and used these databases in the CAD of products.

In the electronics industry, a centralized development method was used. Foreign experts were retained to be chief designers to develop CAD systems for integrated circuits. A three-level integrated circuit CAD system has been developed and is in β testing stage. Several organizations in China have developed PCB (printed circuit board) CAD software packages. The ministry of mechanical and electronic machine building has evaluated them and selected four outstanding packages and two practical packages.

In the area of engineering design, we digested the four major workstations imported in the Seventh 5-Year Plan and carried out a secondary development effort to cover the entire process of exploratory design. A large number of applications software packages were also developed for microcomputer-based workstations, including over 300 rated as outstanding engineering design software packages.

In aerospace, integrated CAD/CAM systems for the design and production aircraft were developed. For example, the APTX multi-axis digital control programming system has been expanded into 10 sets to replace imports. This saves several million dollars in hard currency. In addition, we have developed an automatic electronics design system and an antenna design system for the aerospace industry.

Special CAD software packages were also developed for the ship building, textile and transportation industry and the results are quite good.

In addition, molding is an equipment which involves a number of industries. Many organizations are developing CAD software for impact molding, cast molding and injection molding. A number of preliminary software packages have been created. However, they are still quite far off from meeting the need of the molding industry. We don't have a CAD system suitable for the design of molds.

A technical team has been formed and development bases have been or are being constructed.

According to incomplete statistics, there are approximately 14,000 technical professionals engaged in the development of CAD technology in various organizations under the jurisdiction of nine ministries including electrical and mechanical machine building. There are over 2,000 CAD workstations and 10,000 microcomputer-based workstations, The cost is estimated to be near 300 million dollars. The software to hardware ratio is 1:1.

In order to further advance basic and applied research in CAD technology, a national key laboratory for "computer assisted design and pattern recognition" at Zhejiang University and an open CAD laboratory at the Chinese Academy of Sciences have been constructed.

An open laboratory for modern CAD/CAM manufacturing laboratory at Shenyang Institute of Computing of the Chinese Academy of Sciences and a national key laboratory for mold design and manufacturing at Huazhong Institute of Technology are being built.

In the 863 high technology CIM experimental project, a CIM experimental engineering center has been built. It has two open laboratories. Furthermore, four key application plants have been identified to create conditions for further research and development of CAD technology.

In addition, a number of CAD application development centers have been established in higher learning institutions such as Qinghua, Fudan, Tongji, Beijing Institute of Aeronautics and Astronautics, and Northwest Politechnical University. These are important experimental bases training grounds for CAD technology. In some newly developed technology parks, there are a few companies working on CAD technology.

There are some problems.

Although we have made considerable progress in CAD technology and its applications, however, it is still in its infancy. The applications are fairly narrow. For example, China produces over 50,000 types of mechanical products in 152 major categories. Nevertheless, only 24 key mechanical products use CAD technology. Compared to developed nations, the gap is very wide. Major problems hindering CAD technology from making further advances are:

1. We have not yet established our own CAD industry.

Due to insufficient infusion of capital in the Seventh 5-Year Plan, although 32-bit engineering workstations were successfully developed by the computer industry, it has not been expanded to scale. We still cannot provide complete sets of hardware and software. The use of CAD technology in the Seventh 5-Year Plan was primarily dependent upon imports. It cost a great deal of hard currency. Presently, equipment imported at the beginning of the Seventh 5-Year Plan needs to be replaced and new CAD applications are being developed. Based on incomplete statistics, we need 60,000 engineering workstations and microcomputer-based workstations in Eighth 5-Year Plan and will cost at least 1 billion dollars. It is obvious that it is not feasible to build our own CAD applications on foreign businesses.

2. Although a substantial number of CAD software packages were developed during the Seventh 5-Year Plan, however, most have not reached the status of being practical and cannot be integrated and commercialized for widespread use.

Most users purchase CAD software from abroad. The copyright fee to use such software on each workstation is 3 - 5 times that of the hardware. It is very costly and consumes a large amount of hard currency. Therefore, there is an urgent need to provide large users with copyright software.

The process to commercialize a CAD software is to modify software developed in the laboratory to make it more practical for a large number of end users. Here, we need to test and use the software to discover and correct mistakes so that its reliability can be improved. It is necessary to developed a variety of interfaces to suit different hardware. Through testing, we must continuously perfect it and come up with new revisions. Furthermore, we need to work on items such as installation, operation, technical training, software maintenance and secondary development. Hence, it is a vital and difficult effort which requires a great deal of manpower and money. However, because our software is cheap and has no copyright protection, there is very little progress made in this area over a long period of time. It is a key factor hindering the widespread use of CAD technology. We must solve this problem now.

3. Most businesses rely on government funding to use CAD technology and have not created a healthy development cycle.

In the Seventh 5-Year Plan, CAD applications were primarily dependent on government funding. This was absolute necessary during the initial stage. However, due to various reasons (such as lack of planning, poor choice of equipment purchased, lack of technical support, etc.), quite a few organizations have not benefited from such investment and have not developed a healthy development cycle. Some organizations, despite the fact that they have benefited a great deal by using CAD technology (such as saving construction capital by 2 percent), due to poor policy, the business (or design institute) cannot enjoy the benefit. They even don't have the budget to upgrade and maintain their CAD equipment. It is hard to make any progress. Therefore, they still require government support. This is another reason affecting the widespread use of CAD technology.

4. Lack of human resources is an important reason affecting the widespread use of CAD technology.

Most designers do not have CAD training. Higher learning institutions do not have the facilities to train people to use CAD technology. Most middle age and older designers are very experienced, but are unaware of and not trained to use CAD technology. In addition, the computers in most engineering colleges cannot meet the requirement for CAD training. Thus, even recent graduates have this problem. The limited CAD technical strength is mostly concentrated in large research institutes, large design institutes and large businesses. This makes the shortage of CAD personnel more serious in medium and small organizations. This is another key issue affecting the widespread use of CAD technology which requires our attention.

5. The government does not have a consistent and forceful plan for the research, development, promotion and application of CAD technology.

In the Seventh 5-Year Plan, the government did not make sufficient investment in the development of CAD hardware and software. The small investment was scattered. This is a reason why CAD hardware and software cannot be produced in quantity. There is a great deal of redundancy in the research and development of CAD applications software packages. For example, there are over 60 CAD software packages for designing clothes. It is a waste of manpower, resources and money.

6. Some business leaders and technical personnel do not recognize the significance of CAD technology.

There is considerable resistance against changing traditional design method. Hence, there is not enough desire and motivation to adopt CAD technology.

Architecture of Domestically Developed HUASUN 4000-Series RISC Workstations

92FE0046 Shenyang XIAOXING WEIXING JISUANJI XITONG [MINI-MICRO SYSTEMS] in Chinese Vol 12, No 9, Sep 91 pp 1-7, 30

[Article by Qiao Peng [0829 1756] of Ministry of Machine-Building and Electronics Industry Sixth Institute, Beijing: "Architecture of HUASUN 4000 Series Workstations"]

[Text] Abstract

The HUASUN [hua sheng—5478 0524] 4000 is China's first RISC workstation series and includes three models, the HUASUN 4260, HUASUN 4060, and HUASUN 4065. This article discusses the advanced technology employed in the HUASUN 4000 series, including the RISC architecture, new bus structure, and DVMA technology, and it introduces the advanced structure of the HUASUN 4000 series.

I. Introduction

HUASUN 4000 series workstations are China's first domestically produced RISC workstation series. All of them use an open-type SPARC structure for a CPU and employ UNIX for their operating system and OPENLOOK as a user graphics interface. The members of the HUASUN 4000 family are completely binary code level-one compatible and they are entirely compatible with the Sun-4 series from the Sun Company in the United States and with the SPARCstation series. The HUASUN 4000 series is a powerful computer system whose performance exceeds that of traditional minicomputers and attains advanced levels of foreign countries in the early 1990's.

There are currently three models of HUASUN 4000 series workstations: the HUASUN 4260 is a deskside system with a VME bus, a clock frequency of 16.67 MHz, and a performance of 10MIPS. The HUASUN 4060 is a desktop system with an SBus bus, a clock frequency of 20 MHz, and a performance of 12.5MIPS. The HUASUN 4065 is also a desktop system that uses an SBus bus and has a clock frequency of 25MHz and a performance of 16MIPS. All of the HUASUN 4000 series workstations have 1152x900 graphics display resolution and are capable of simultaneously displaying 256 colors. In their minimum configuration, the systems also include a magnetic device controller, an Ethernet interface, two serial ports, keyboard/mouse port, and other functional modules. In an individual computer, these functions require an add-on expansion card. In the HUASUN 4000 series workstations, the minimum internal memory capital is 8MB and the maximum is 128MB.

HUASUN 4000 series workstations were designed and developed on the basis of "Open System" principles. An open system means that in the computer system, every attempt is made to use existing industrial standards or be identical to existing industrial standards. In the industrial standards adopted for the HUASUN 4000 series, the hardware has a SPARC structure, VME bus, SBus bus, Ethernet and SCSI magnetic device interfaces, RS232C serial ports, and so on. The software uses the UNIX operating system, NFS network document system, X- windows window system, OPENLOOK user graphics interface, and so on. The use of these industrial standards gives the system maximum flexibility and universality, and it effectively conserves development costs, shortens development schedules, and greatly increases the performance/price ratio.

II. SPARC Structure—Representative of Open-Type RISC Technology

RISC technology means "reduced instruction computer technology" and has become the main trend in the workstation realm. It is also now becoming an important part of the minicomputer to mini-supercomputer market. There are three most popular RISC structures in the world at present: the MIPS Corporation's MIPS, Motorola Corporation's 88000, and the Sun Corporation's SPARC. In comparison, the MIPS structure has found favor because of its higher technical performance while the 88000 has revealed its grace in multiprocessor systems. There is no doubt, however, that SPARC has achieved the maximum success in the workstation market. According to statistics from Data Quest, SPARC accounted for 55.4 percent of the RISC workstation market in 1989 and grew to 66.1 percent in 1990. The main reason for the success of SPARC was that the Sun Corporation promoted SPARC as an industrial standard and adopted a thorough open-type strategy. For example, SPARC technology authorizations were provided to many semiconductor firms for production and marketing and a SPARC International Company independent of the Sun Corporation was established and given responsibility for transferring SPARC technology, formulating technical standards for the SPARC structure, encouraging system-level compatible firms and other independent software and hardware firms, and so on. These measures were a huge success. There are now over 20 firms producing SPARC compatible workstations (including the HUASUN 4000 series) and over 70 plants producing board-level expansion products with the number of product varieties exceeding 100, including multiplex input-output cards, disk controller cards, network cards, 386 co-processors, and many other products than can be bought in the market. In the area of software, there are now 3,000 "SPARCWARE" applications programs. The SPARC system is now becoming the "other PC" of the 1990's.

Figure 1 illustrates the typical organization of the SPARC structure. It includes an integer unit IU and a floating point unit FPU. In actual use, the integer unit and floating point unit can be integrated onto a single chip or they can be integrated separately. SPARC is a typical RISC structure so it has several characteristics in common with a regular RISC structure:

1. Single cycle instruction: implementation of most instructions is completed in a single machine cycle.

2. Elimination of microcodes, full use of hardline logic: traditional microcodes increase the program complexity of CPU and increase the number of cycles for execution of instructions, which has negative effects on structural streamlining.

3. Register operating design: nearly all the operation instructions only require the use of an immediate number and register as an operating number, and only the Load and Store instructions have a few limited types of addressing patterns to access memory units outside the CPU.

4. Simple and unified instruction format: all instructions are 32 bits long.

5. Streamlined structure: four-stage streamlined processing is achieved for fetching instructions, decoding, execution, and writeback.

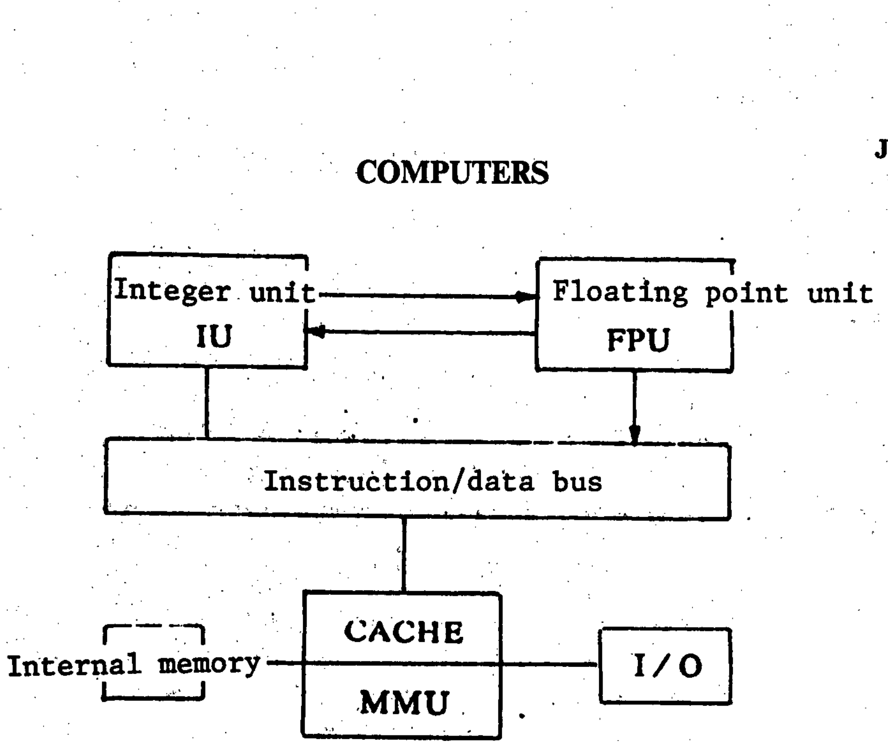


Figure 1. Organization of a SPARC Structure

6. Large amounts of high-speed memory applications: regular RISC structures use at least 32 general-purpose registers, whereas the SPARC structure uses more than 120 general-purpose registers, which greatly reduces the communication channel callup time for memory outside the CPU.

In addition to these characteristics in common with regular RISC, SPARC also has several unique designs:

1. Delayed jump: when the processor encounters a jump instruction, it first executes the instruction following the jump instruction and then jumps to the corresponding program input. This increases the degree of parallel processing of the program and the CPU does not waste time reading in the jump instruction.

2. Labelled instructions: in a labelled instruction, it can be known whether the operating number is a integer or an address. This is extremely beneficial for interpretive languages like LISP and Prolog, so it is especially appropriate for artificial intelligence systems.

3. Register windowing technology: the SPARC structure uses large numbers of high-speed general-purpose registers to make a register window overlapping rotation structure. Figure 2 illustrates this type of register window overlapping rotation structure. According to the standards that define SPARC, 6 to 32 register windows are allowed (usually only 7 or 8 are used at the present time) and each window has 24 registers, and there are eight that overlap between two adjacent windows. Under normal conditions, the CPU can only "view" 24 registers and 8 global registers through a window. These 24 registers are divided into three groups: 8 input registers, 8 local registers, and 8 output registers. The output registers of a window are actually the input registers of the window below. When the program executes a subprogram call, the input parameter only has to be loaded into the input register, after which the register window pointer rotates counter-clockwise and points to a window, so the input register that loaded the input parameter in the original window becomes the output register for the present window. When the subprogram completes processing these input parameters and returns from the called program, the situation is the opposite: first, the operation results are loaded into the output register and then the window pointer rotates clockwise and points once again to the window of the called program. At this time, the parameter that appears in the input register is the result of the subprogram call. The adoption of register window technology does not require the storage and restoration of input parameters before each call and return, which greatly reduces the number of accesses of external low-speed memory and effectively increases the operating speed of the CPU.

When evaluating the computer system, its performance indicator P is provided by the following formula:

$$P = S/(I \times C)$$

In the formula, I is the number of instructions that must be implemented during performance testing, C is the average number of clock cycles required to execute each instruction, and S is the clock frequency. If I is in units of "million instructions per second", then MIPS is the unit for P. The advanced design of SPARC gives it greater performance compared to a traditional CISC structure with an identical clock frequency. The table below lists comparisons of SPARC with two typical CISC structures with an Intel 80386 and Motorola 68030. The results are apparent (see Table 1).

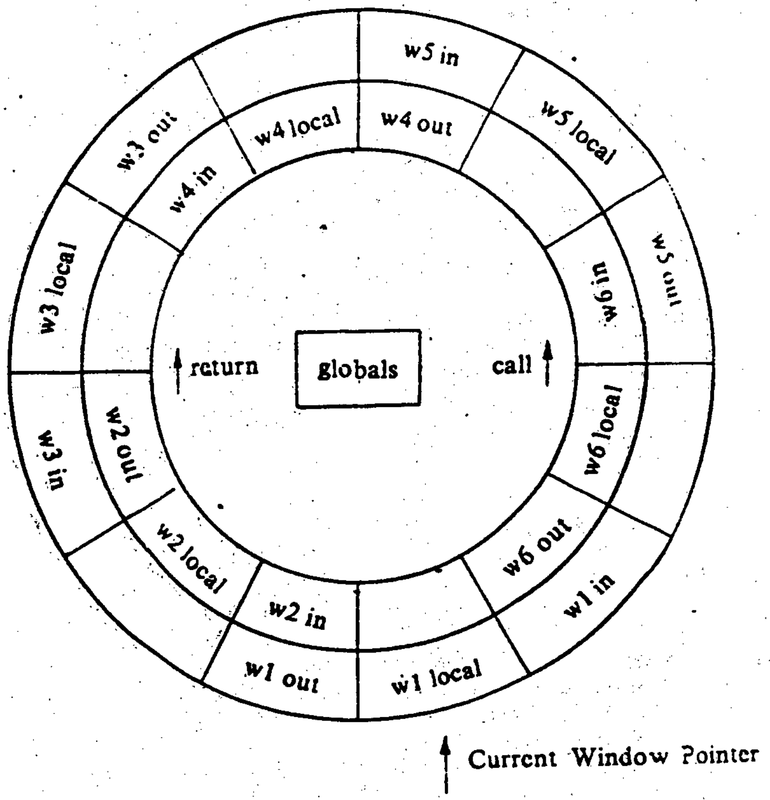


Figure 2. Register Windowing Technology

Table 1. Comparison of Various Structures at a Clock Frequency of 16.67 MHz

Type of CPU	Number of instructions I	Average number of cycles per instruction C	Performance P (MIPS)
Motorola 68030	1.0	5.2	3.21
Intel 80386	1.1	4.4	3.44
SPARC	1.2	1.3	10.69

III. "Master—Slave" Type Structure and "Direct Virtual Memory Access" DVMA Technology

Several simple busses like an AT bus are usually controlled directly by the CPU. Concretely speaking, the transfer cycle for each bus that is activated by the CPU carries out a read-write access of the other bus devices. There is an exception, however, which is the DMA transfer cycle. When large amounts of data must be exchanged between certain peripherals and internal memory, if the CPU permits, the DMA controller replaces the CPU and gains control rights over the bus to enable this type of data exchange without going through the CPU. This reduces the burden on the CPU to a certain extent. In most cases, however, the CPU must still complete large numbers of complex bus management tasks, which reduces overall system performance. To reduce the burden on the CPU to the greatest possible extent and increase system performance, all HUASUN 4000 series workstations use an advanced "master—slave" type structure bus. The primary characteristics of this type of structure are, one, all devices on the bus are divided into two types, bus masters and bus slaves. The masters can control the bus, activate bus transfer cycles, and access the slaves, whereas the slaves can only be passively be controlled, selected, and read-written by the masters. Second, it has a special independent or semi-independent bus resolver that is responsible for determining which master should control the bus at that time. In this type of system with a "master—slave" structure, the CPU can serve as a common master and gains bus control rights only when required. It can also function as a part of the bus resolver and partially participate in management of the entire bus. The "master—slave" type bus structure effectively increases overall system performance.

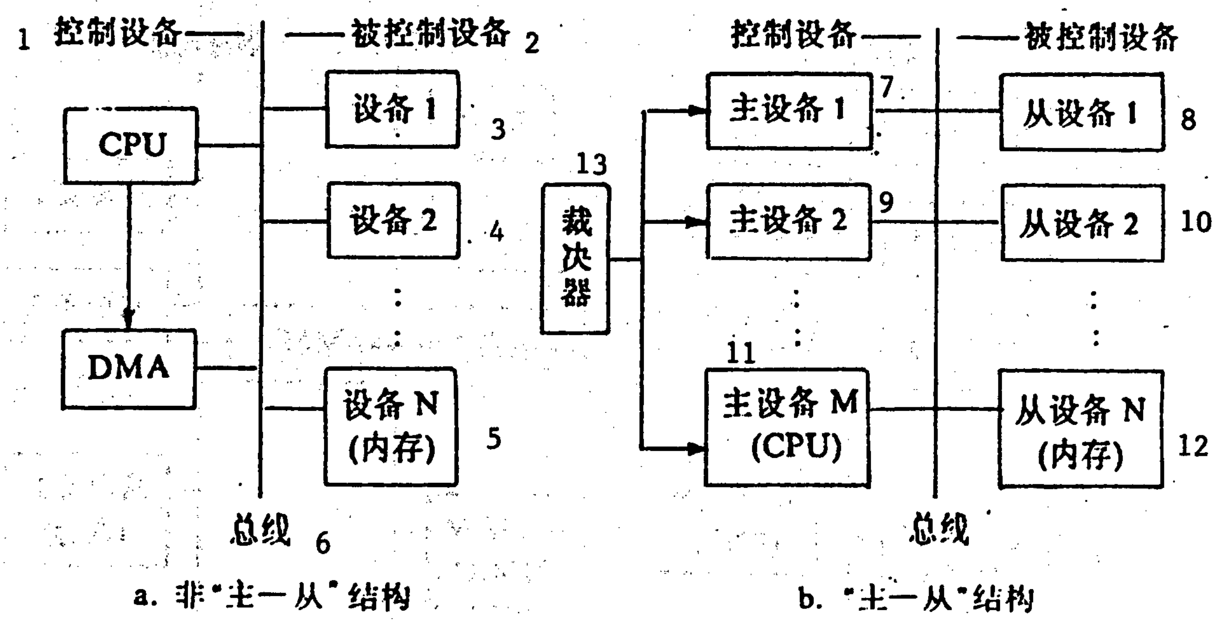


Figure 3. Comparison of a "Master-Slave" Structure and Non-"Master-Slave" Structure

Key: a. Non-"master-slave" structure; b. "Master-slave" structure; 1. Control device; 2. Controlled device; 3. Device 1; 4. Device 2; 5. Device N (internal memory); 6. Bus; 7. Master 1; 8. Slave 1; 9. Master 2; 10.Slave 2; 11. Master M (CPU); 12. Slave N (internal memory); 13. Resolver

---

Figure 3 illustrates the differences between a "master—slave" type structure and a non-"master—slave" type structure bus. The illustration shows that the non-"master—slave" type structure is merely a special situation of a "master—slave" type structure: the CPU and DMA controller become the only two bus masters in the system and the CPU also serves as a bus resolver while the internal memory and other bus devices become slaves. In the opposite sense, the "master—slave" type structure can be considered to be an expansion of a non-"master—slave" type structure: the devices outside the CPU can be understood as several DMA controllers on the bus whereas the slaves are an expansion of the concept of "internal memory".

The "direct virtual memory access" technology developed by the Sun Corporation, abbreviated as DVMA, is a concrete embodiment and improvement of the concept of expanded DMA. Figure 4 illustrates the differences between DVMA and traditional DMA. In regular computers, the MMU (if it is present) is only an auxiliary part of the CPU whose function is to convert the virtual addresses generated by the CPU into physical addresses. Thus, regular busses are unrelated to MMU and virtual addresses and their signal structure only has a physical address bus and does have a virtual address bus. When the DMA controller is controlling the bus, it also provides the physical address of internal memory. In the DVMA concept, however, all of the masters (including the CPU and the DMA controller in the broader sense) provide virtual addresses that must be converted by the MMU before they can be converted into physical addresses for selection of the slave that must be accessed (such as internal memory). Thus, in the bus structure, first, a virtual address bus must be added and second, the MMU is no longer simply a dedicated auxiliary part of the CPU but instead becomes a required part of the bus to convert all of the virtual addresses provided by the master into physical addresses.

This type of master on the bus that uses DVMA technology is called a DVMA master. The biggest advantage of DVMA is that it greatly simplifies the design and compilation of the operating system and internal memory management software while at the same time enabling the I/O devices to take advantage of things like the advanced concept of requesting page-type virtual memory. For example, for a drive program for a laser printer that requires 1MB of internal memory, it can be considered to be a continuation of this 1MB of internal memory in the virtual address space despite the fact that they are not continued in the physical address space.

Among the HUASUN 4000 series workstations, the HUASUN 4260 uses a VME bus while the HUASUN 4060 and HUASUN 4065 use SBus busses. Both of these types of busses are "master—slave" type structures and they both use DVMA technology.

IV. VME Bus Deskside System—HUASUN 4260

The HUASUN 4260 is a deskside system with very powerful functions that uses a VME bus as the system bus. Its core, the CPU board, is itself a high-performance single-board computer. The HUASUN 4260 uses

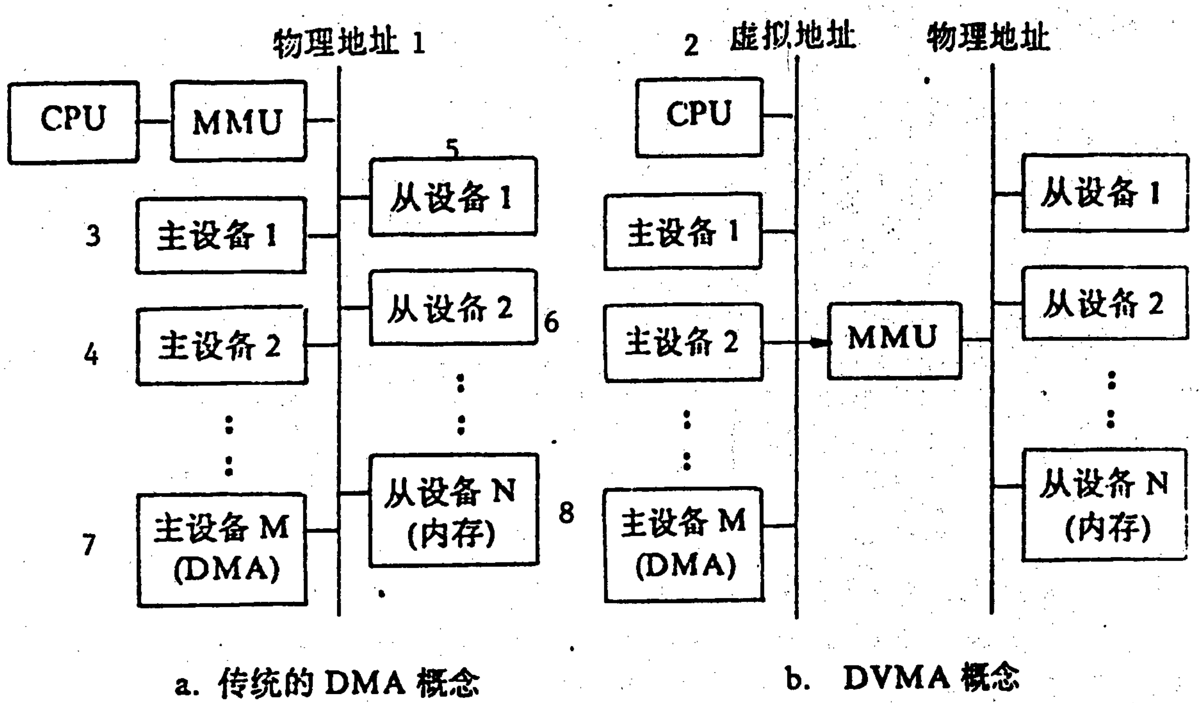

物理地址 1
2 虚拟地址
物理地址
CPU
MMU
主设备 1
主设备 2
主设备 M (DMA)
从设备 1
从设备 2
从设备 N (内存)
3
4
5
6
7
8
CPU
主设备 1
主设备 2
主设备 M (DMA)
MMU
从设备 1
从设备 2
从设备 N (内存)
a. 传统的 DMA 概念
b. DVMA 概念

Figure 4. Comparison of DVMA and DMA

Key: a. Traditional DMA concept; b. DVMA concept; 1. Physical address; 2. Virtual address; 3. Master 1; 4. Master 2; 5. Slave 1; 6. Slave 2; 7. Master M (DMA); 8. Slave N (internal memory)

the first generation SPARC structure S-16 produced by the FUJITSU Corporation. It includes four chips: an integer unit IU, and floating point control unit FPC, and two floating point operation components that operate at a clock frequency of 16.67 MHz with a performance of 10MIPS and 1.6MFLOPS. It also has a 128kB high-speed buffer, MMU, 32-bit VME bus interface, 256kB monochrome graphics buffer, Ethernet interface, two serial ports, a keyboard/mouse port, and DVMA logic on the CPU board. For this reason, a CPU board is matched up with a board containing 8MB of internal memory to form a monochrome display diskless workstation. This is the minimum configuration for the HUASUN 4260. By adding an SCSI magnetic disk control board, color graphics board, graphics accelerator board, graphics buffer board, multipath communications board, and other optional boards on the VME bus, a color graphics workstation or network server with extremely powerful functions can be formed. Figure 5 shows the system logic

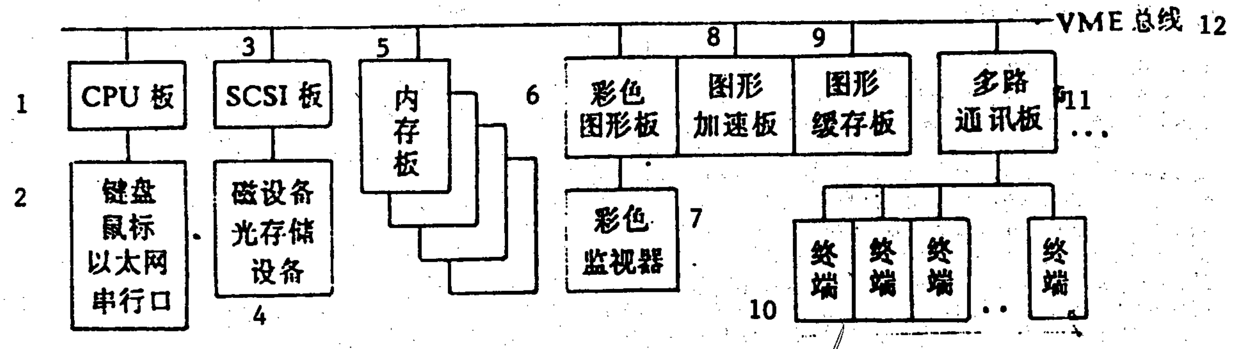

VME 总线 12
1
2
3
4
5
6
7
8
9
10
11
CPU 板
SCSI 板
内存板
彩色图形板
图形加速板
图形缓存板
多路通讯板
键盘 鼠标 以太网 串行口
磁设备 光存储 设备
彩色监视器
终端
终端
终端
终端

Figure 5. HUASUN 4260 System Block Diagram

Key: 1. CPU board; 2. Keyboard, mouse, Ethernet, serial ports; 3. SCSI board; 4. Magnetic devices, optical memory devices; 5. Internal memory board; 6. Color graphics board; 7. Color graphics monitor; 8. Graphics accelerator board; 9. Graphics buffer board; 10. Terminal; 11. Multipath communications board; 12. VME bus

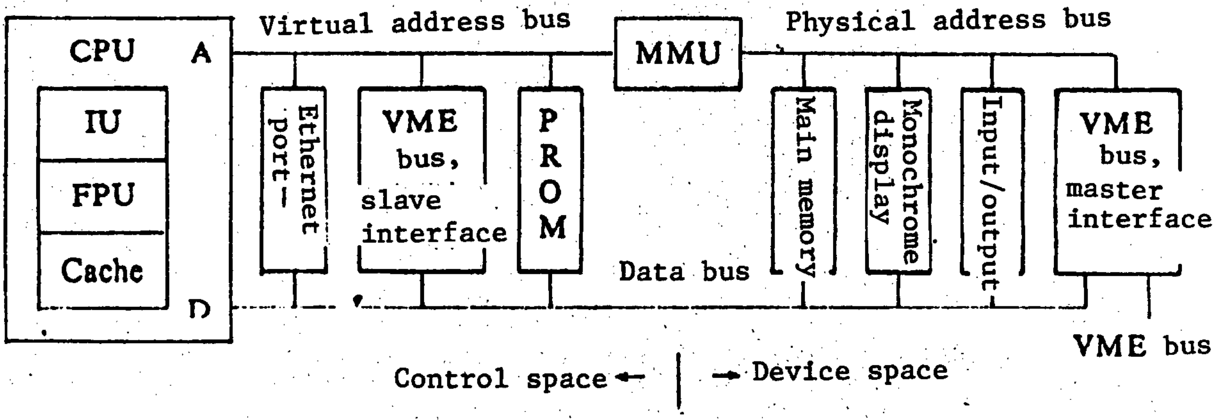


Figure 6. HUASUN 4260 CPU Board Logical Block Diagram

diagram for the HUASUN 4260, while Figure 6 is the logical diagram for the core CPU board of the HUASUN 4260.

The overall system in the HUASUN 4260 can be divided into control space and device space. The control space includes the CPU, Cache, MMU, PROM, and two DVMA masters, an Ethernet interface and VME bus slave interface. They are the control center of the entire system. The device space includes the main memory, monochrome display buffer, serial ports, keyboard/mouse, interrupt circuit, VME bus master port, and other devices on the VME bus. Generally speaking, the devices in the control space like the CPU or DVMA provide the MMU with virtual addresses that are processed and converted into physical addresses, after which the devices in the device space like the main memory or graphics buffer or via the VME bus master port carry out calls or access to the other VME bus slaves. The MMU manages and protects these devices and allows sharing of their resources.

It deserves special mention here that the HUASUN 4260 employs DVMA technology and that the system permits the DVMA masters to use the MMU as the CPU does to access the device space. There are two DVMA masters. One is the Ethernet controller. When a large amount of data is exchanged between the Ethernet and the internal memory, the Ethernet controller replaces the control rights of the CPU in joint management of the MMU and provides virtual addresses to the MMU and, after conversion into physical addresses, the internal memory is accessed. After the data exchange is completed, the control rights of the MMU are returned to the CPU. The other DVMA master is the slave ports on the VME bus. The other devices on the VME bus in the "master—slave" type structure like the SCSI communications board pass through the VME bus slave ports (the CPU becomes a slave at this time) and access of the device space (such as the main memory) can be completed in the virtual address space. Other access processes are similar to the Ethernet controller.

The HUASUN 4260 has extremely powerful expansion functions. Besides functioning as a workstation, it can be configured with a super-large capacity disk and as many as 66 terminals for use as a high-performance network server.

V. SBus Bus Desktop Systems—The HUASUN 4060 and HUASUN 4065

The pace of development of engineering workstations has been speeding up since the late 1980's, and there have been continual improvements in performance and they are become increasingly small in volume. Desktop systems are becoming increasingly common and they have become the main trend in the medium and low-grade workstation market. Because of their slower speed and larger mechanical dimensions, VME busses have gradually become inappropriate. Several new types of busses suitable for desktop systems have begun to become popular and their speed has become an industrial standard. The HUASUN 4060 and HUASUN 4065 are successfully developed high-performance desktop workstation systems that are adapted to international trends, employ a new type of SBus bus, and use the newest achievements in integrated circuit development.

An SBus is a "master—slave" type structure 32-bit bus with a peak transmission rate of as much as 100MB/second. Still, they are very small in volume. A single-width SBus expansion card is just the size of an adult's hand. They have a different structure from the vertical expansion cards and motherboards used in PCs. An SBus expansion card is horizontal, so it runs parallel to expansion cards and motherboards. This design can reduce the height of the computer case and is especially suited to desktop systems. Moreover, it is extremely suitable for use as a rather large functional module, such as the Daughter Board for a VME function board. In the signal combinations of the bus, besides those like a regular bus, which has a data bus, physical address bus, control signals, and interrupt signals, it has an additional virtual address bus (time-division multiplexing with the

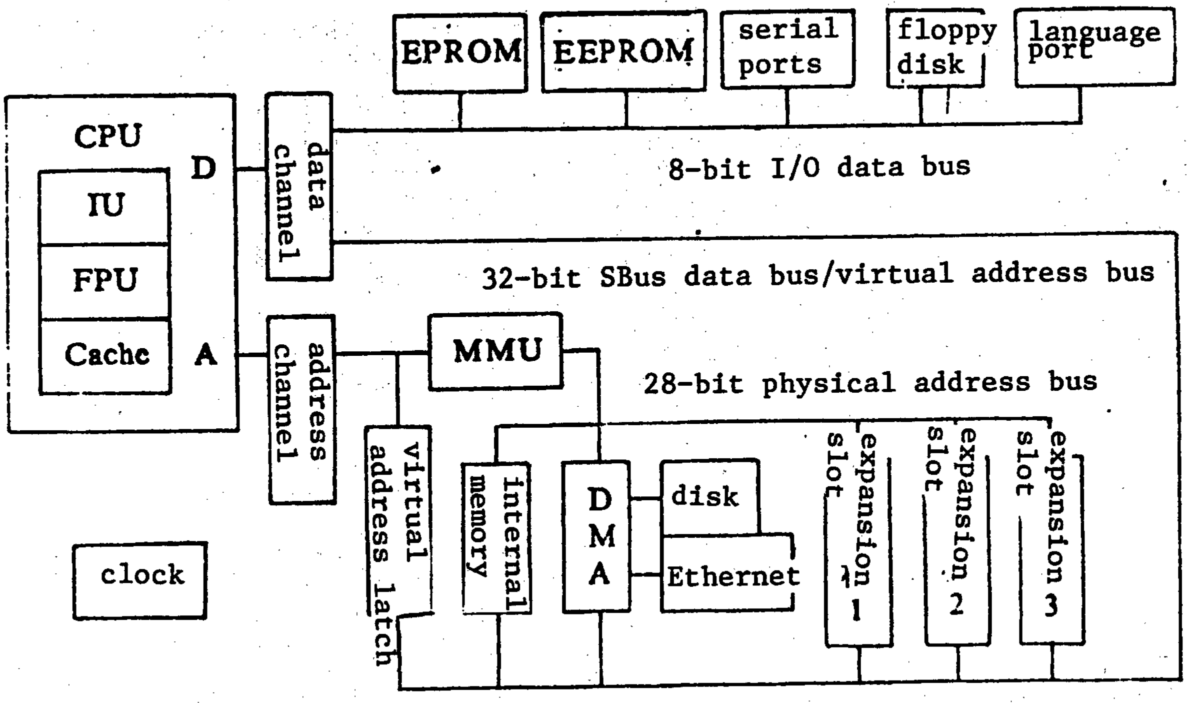


Figure 7. HUASUN 4060/4065 CPU Board Logical Block Diagram

data bus) to achieve DVMA technology. The main characteristics of an SBus are:

- 32-bit or 64-bit data bus
- 32-bit virtual address bus (time-division multiplexing with data bus, driven by the bus master)
- 28-bit physical address bus (select and read-write bus slaves)
- MMU responsible for providing address conversion services to all bus masters (including the CPU and DVMA masters)
- 16.67 MHz to 25 MHz clock frequency
- With the exception of interrupt signals, all other signals are synchronous operation
- A maximum of 8 bus masters
- Supports burst transferring, with a maximum transfer of 64 bytes in one bus transfer cycle
- Signal levels compatible with CMOS components
- 7 interrupt signal lines, supports asynchronous operation

The HUASUN 4060 and HUASUN 4065 are the first group of desktop RISC workstations with an SBus as a system bus produced in China. The HUASUN 4060 operates at a clock frequency of 20 MHz and its performance is 12.5MIPS. The HUASUN 4065 operates at a clock frequency of 25 MHz and its performance is 16MIPS. Apart from the speed difference between the two, their architecture is basically identical. Figure 7 is a logical block diagram of the motherboard. The motherboards of the HUASUN 4060 and HUASUN 4065 include an IU, FPU, 64kB high-speed buffer, a maximum of 64MB of internal memory, an SCSI magnetic device interface, an Ethernet interface, two serial ports, a voice port, and three SBus expansion card slots. Their dimensions, however, are equivalent to the size of a common sheet of paper. During actual operation, if the bus masters (for the DVMA master, the magnetic disk or Ethernet, for example) require access to the slaves (the internal memory or graphics buffer, for example), they use the data bus to supply a virtual address to the MMU and after conversion it accesses the slaves on the next beat. If the CPU accesses the slaves, it can directly provide a virtual address to the MMU and does not require the use of the SBus data bus. In bus resolution, the preference level of the DVMA master is higher than the CPU master. Color graphics cards, monochrome graphics cards, graphics accelerator cards, multipath input-output cards, and various other selection boards can be inserted in the three SBus expansion card slots so that the overall system can satisfy different requirements in actual work.

The HUASUN 4060/4065 are advanced workstation systems as well as a successful achievement of an SBus bus. With the rapid development of computer technology and the semiconductor industry, this type of "SPARC+SBus+Desktop+UNIX" compatible system will become increasingly common internationally and within China.

References

1. An RISC Tutorial, Sun Microsystems, Inc., Part Number: 800-1795, May 9, 1988.

2. The SPARC Application Binary Interface, SunTech Journal, March 1989.

3. The SBus Specification Revision B.0, Sun Microsystems, Inc., Part Number: 800-5922-10, December 1990.

4. HUASUN 4260 RISC Gongzuozhan Jishu Shuomingshu [Technical Manual for the HUASUN 4260 RISC Workstation], Ministry of Machine-Building and Electronics Industry Sixth Research Institute, December 1990.

5. HUASUN 4060 RISC Gongzuozhan Jishu Shuomingshu [Technical Manual for the HUASUN 4060 RISC Workstation], Ministry of Machine-Building and Electronics Industry Sixth Research Institute, December 1990.

6. HUASUN 4065 RISC Gongzuozhan Jishu Shuomingshu [Technical Manual for the HUASUN 4065 RISC Workstation], Ministry of Machine-Building and Electronics Industry Sixth Research Institute, December 1990.

Nation's First Independently Developed FMS Passes Technical Appraisal

92P60114A Beijing ZHONGGUO KEXUE BAO [CHINESE SCIENCE NEWS] in Chinese 24 Dec 91 p 1

[Article by Gao Jingtai [7559 2529 3141]: "Nation's First Flexible Manufacturing System Unveiled in Changchun"]

[Summary] Changchun (ZHONGGUO KEXUE BAO wire report)—The nation's first independently designed and developed flexible manufacturing system (FMS) recently passed expert technical appraisal in Changchun. This FMS, jointly developed by MMEI's Changchun Institute 55, Mianyang Institute 58, and East China Institute of Technology in a three-year-plus effort, can fulfill 30 different tasks within one time period; it operates stably with a high degree of machining accuracy. The overall cost of manufacturing this system is much lower than that of similar foreign-made systems.

Second-Generation PLC Unveiled in Shanghai

92P60114B Beijing ZHONGGUO DIANZI BAO [CHINA ELECTRONICS NEWS] in Chinese 27 Dec 91 p 2

[Article by Ji Xianzhong [1323 3759 1813]: "Xiangdao Begins PLC Market Offensive: Initiates Three-Power Rivalry With Mitsubishi, Toshiba"]

[Summary] The ACMY-S80 series of second-generation programmable logic controllers (PLC) independently developed by Shanghai's Xiangdao [7449 1497] Company, via testing at MMEI's Beijing Institute of Automation, has been found to meet 1980's international standards, and has been formally put into batch production, with 2,500 units expected to come off the line in 1992. Domestic production of PLCs has lagged far behind the market demand, which has been growing at an annual rate of 25 percent, and it is in such a climate—and with very limited resources—that the Shanghai firm took it upon itself to develop this line of new products, of which 100 have been sold so far. The new series, which replaces the S256 product series, is expected to provide powerful competition with Mitsubishi's products and with Toshiba's EX40+ product series. Hardware price is two-thirds to one-third that of imported products, and software price (software plus interfaces) is only 6 percent that of imported products.

New-Generation Mid-to-Long-Range 3D Air-Defense Intelligence Radar Design Finalized

92P60090A Beijing ZHONGGUO DIANZI BAO [CHINA ELECTRONICS NEWS] in Chinese 29 Nov 91 p 3

[Article by Jiang Deqing [1203 1795 3237]: "Mid-Long-Range Three-Coordinate Radar Passes State Level-1 Design Finalization"]

[Summary] The new-generation mid-to-long-range three-coordinate air-defense intelligence radar developed by an East China institute passed the state level-one design finalization conducted the other day by the State Aerospace Product Design Finalization Committee. This new radar, in development for several years, has undergone a specified period of field testing which has certified that its tactical performance indicators meet all of the design requirements. The committee members unanimously agreed that this radar is the first independently developed mid-to-long-range fully coherent three-coordinate radar, that it is highly automated and adaptive, that it provides ample data storage and automatic printout, and that it can serve as the mainstay air-defense radar. The new radar incorporates a pile-up multi-beam amplitude comparison altimeter system and has an advanced overall design.

Development of DBF Technology for Domestic Radar

92P60100B Beijing ZHONGGUO DIANZI BAO [CHINA ELECTRONICS NEWS] in Chinese 8 Dec 91 p 3

[Article by Tian Ding [3944 0002]: "From the 1991 International Radar Conference: Examining the Domestic Development of Radar DBF Technology"]

[Summary] It has been learned from Chinese representatives to the recently convened '91 International Radar Conference that the publishing of their papers on current topics in radar research indicates that the nation can take its place in the front ranks of the world radar technology community. The conference devoted much attention to the study of digital beam-forming (DBF) radar technology, which got its start in the sixties. Chinese researchers began studying DBF technology in the late seventies, and made important advances in the eighties. Radar DBF technology is a melding of radar antenna beam-forming technology with advanced digital signal processing (DSP) technology. The digital beam-former and beam controller make up the heart of a DBF radar. In essence, a DBF radar samples the receiver echo signal's amplitude and phase and then employs digital computing technology for intelligent control, DSP, weighting, and summation of the sampled signals; it reduces an n-dimensional signal down to a one-dimensional signal, forming an inner-product (or dot-product) beam.

MMEI's Institute 38 has built a C-band 8-element equispaced linear array experimental DBF system which takes all the individual single-scan beams with their low minor lobes, and forms a total of eight independently controlled weighted-sum or weighted-difference beams. They have adaptive zero-adjustment and frequency-channel calibration capability, and can operate in CW mode or 4-microsecond pulse mode. The antenna array's minor lobe level is less than -30dB. Satisfying results have been obtained in experiments on real-time calibration techniques to eliminate the principal errors in the DBF array and receiver.

Chinese engineers have also applied DBF technology to over-the-horizon (OTH) radar and bistatic (or multistatic) radar research, permitting variable antenna directional plots, use of pulse quickening to achieve spatial synthesis, and other advanced techniques. In theoretical research, MMEI's Institute 14 has proposed a spatial spectral estimation high-performance fast algorithm, and has also published a practical study on flexible applications and development of a variety of algorithms already established in the international community.

DC SQUID Magnetometer With Nb-SiO_2-Nb Edge Tunnel Junction

92P60094A Beijing YIQI YIBIAO XUEBAO [CHINESE JOURNAL OF SCIENTIFIC INSTRUMENT] in Chinese Vol 12 No 4, Nov 91 pp 337-343

[Article by Zhang Lihua [1728 0448 5478], Chen Lie [7115 3525], Weng Yaojun [5040 1031 6874], and Chen Jiagui [7115 0163 0964] of the Institute of Physics, Chinese Academy of Sciences: "DC SQUID Magnetometer Using Nb-SiO_2-Nb Edge Tunnel Junction", MS received Aug 90; cf. JPRS-CST-91-011, 31 May 91 p 32]

[Abstract] Using Nb-SiO_2-Nb edge tunnel junction, a DC SQUID magnetometer is fabricated. A superconducting resonant transformer is used as the impedance matching element, and the contribution of the preamplifier to the output noise is negligible. The flux noise (effective or rms value) is $1 \times 10^{-4}\ \varphi_0/(Hz)^{1/2}$ (where φ_0, the magnetic flux quantum, is about 2.07×10^{-7} gauss-m^2) measured at 1 Hz, and below $5 \times 10^{-6}\ \varphi_0/(Hz)^{1/2}$ measured at 1.77Hz, 17.7Hz, 177Hz, and 1kHz. Equivalent energy noise (i.e. minimum resolvable energy) is 2.5×10^{-28} J/Hz at frequencies under 1Hz, and dynamic range is plus or minus $5 \times 10^6 (Hz)^{1/2}$ at frequencies under 1Hz. Flux modulation frequency is 50kHz. To increase the slew rate, a two-pole integration circuit is used; maximum slew rate is $1 \times 10^5\ \varphi_0$/s at 1.5kHz, a rate which enables the magnetometer to be operated for long periods of time without causing the system to unlock. Input current sensitivity is $0.2\mu A/\varphi_0$, system frequency response (3dB bandwidth) in the fast operating mode is

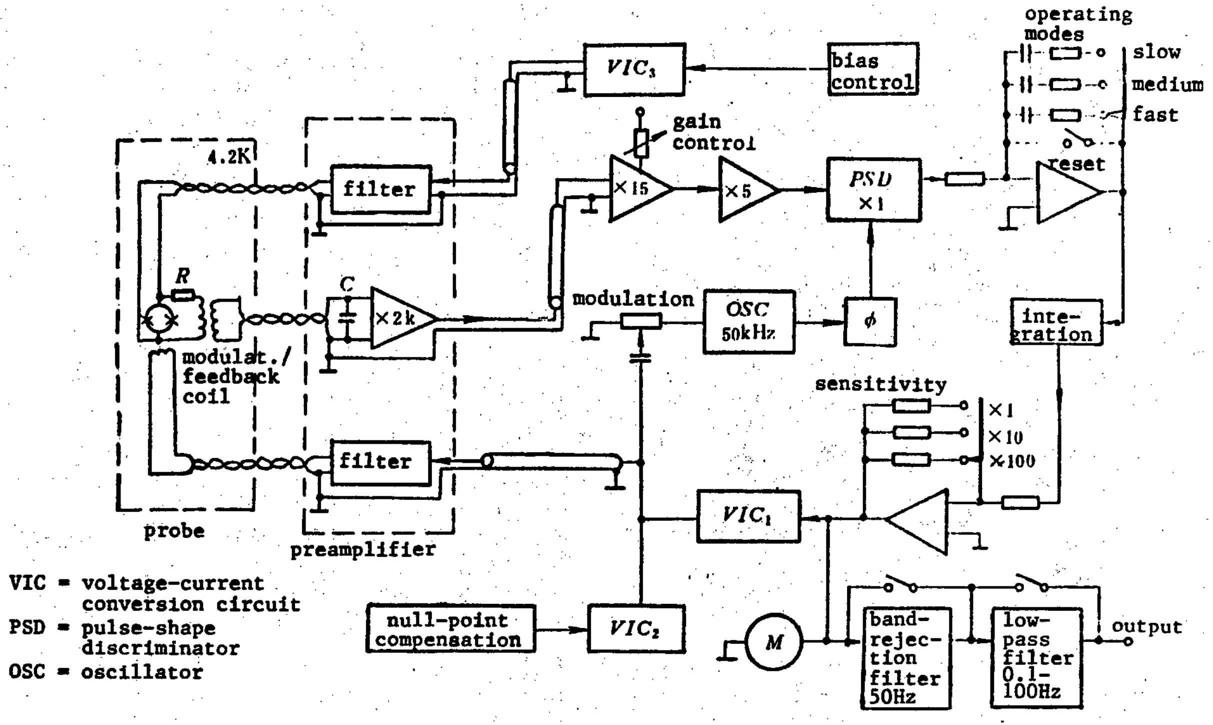

operating modes
slow
medium
fast
reset
VIC_3
bias control
gain control
4.2K
filter
×15
×5
PSD ×1
R
C
×2k
modulation
OSC 50kHz
φ
inte-gration
modulat./feedback coil
sensitivity
×1
×10
×100
filter
VIC_1
probe
preamplifier
VIC = voltage-current conversion circuit
PSD = pulse-shape discriminator
OSC = oscillator
null-point compensation
VIC_2
M
band-rejection filter 50Hz
low-pass filter 0.1-100Hz
output

Figure 1. Schematic of DC SQUID Magnetometer

3kHz, and drift is 7 x 10^{-4} φ_0/h. Following its development, this DC SQUID magnetometer was named the PIC-1, which passed CAS-level technical appraisal in February 1990.

A schematic of the DC SQUID magnetometer construction is shown in Figure 1. Three other figures (not reproduced) depict the transmission function, the open-loop amplitude-frequency characteristics, and the measured (closed-loop) frequency response characteristics. Two tables show the maximum slew rate for different sensitivities and operating modes, and the frequency response for different operating modes.

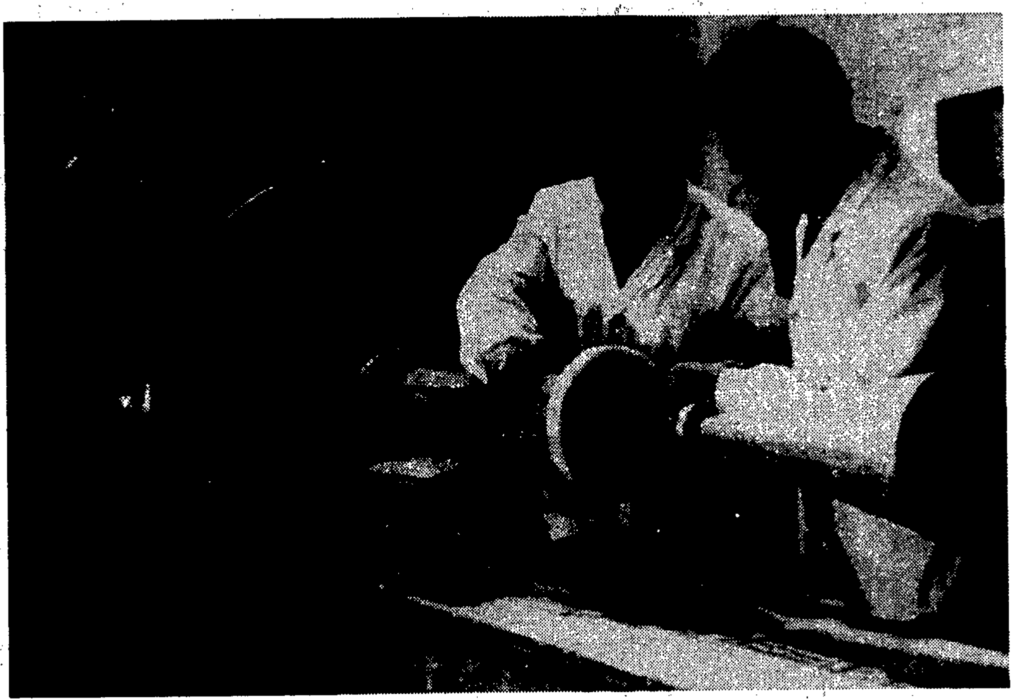
References: 3 Chinese, 3 English.

Relativistic E-Beam Accelerator Used To Produce Cerenkov FEL Output

92P60100A Beijing KEJI RIBAO [SCIENCE AND TECHNOLOGY DAILY] in Chinese 6 Dec 91 p 1

[Untitled Photoreport by Tan Keyang [6223 0344 2254]]

[Text] Recently, the "intense-current relativistic electron-beam accelerator" developed by University of Science & Technology for National Defense Professor Li Chuanlu [2621 0278 5251] and colleagues was used for the first time domestically to achieve Cerenkov free electron laser (FEL) output. The photo shows Prof. Li (left) as he carries out an experiment with this accelerator.



Two Remote Sensing Project Achievements Pass Acceptance Check

92P60115A Beijing ZHONGGUO KEXUE BAO [CHINESE SCIENCE NEWS] in Chinese 20 Dec 91 p 1

[Article by Zhong Ming [6988 7686]: "Major CAS Research Projects: Two Achievements of Remote Sensing Institute Pass Appraisal"]

[Summary] Beijing (ZHONGGUO KEXUE BAO wire report)—Two CAS Remote Sensing Institute project achievements—"Radar Imagery Analysis and Geological Applications" and "Geographical Information Systems Software Tools and Their Applications"—passed acceptance check and appraisal a few days ago. The first, a four-year cooperative project with the CAS Institute of Electronics, includes studies of angle of depression, viewing direction, multiview number, multiple polarization, and resolution; describes the design for the nation's only optimized radar depression angle plot; covers original radar imagery correction techniques and a noise-cancellation operator; and discusses applications in geological prospecting.

The second project covers improved graphics input, editing, processing, search, model analysis, and output techniques. Experts have appraised both project achievements as having reached the international state-of-the-art.

CAEP Achieves Ne-Like Ge Soft X-Ray Laser Saturated Output

92P60115B Beijing KEJI RIBAO [SCIENCE AND TECHNOLOGY DAILY] in Chinese 31 Dec 91 p 2

[Article by Hao Jin [6787 2516]: "Neon-Like Germanium Soft X-Ray Laser Output Reaches Saturation; 'Four-Target Butt-Joint' Technique Used"]

[Summary] Researchers from the China Academy of Engineering Physics (CAEP) recently achieved Ne-like Ge soft X-ray laser saturated output at 23.2 nm and 23.6 nm wavelengths with Shanghai's "Shen Guang" 10^{12} W laser facility, an achievement at the international state-of-the-art. The experiment was jointly conducted with scientists from the Beijing Institute of Applied Physics and Computational Mathematics and the Shanghai Laser Plasma Institute, and with the assistance of the Shanghai High-Power Laser Joint Laboratory and Tongji University. Following upon their successful realization of Ne-like Ge soft X-ray laser output with a dual-target butt-joint configuration [see JPRS-CST-91-013, 20 Jun 91 pp 9-10], the CAEP researchers employed a newly developed four-target butt-joint configuration, with a total target length of 5.6 cm and an on-target laser intensity of 0.8-1.0 x 10BW/cm^2 [as published, should be x 10^{13} W/cm^2]. The intensity-to-length index reached a maximum value of 2 x 10^6 photons/micron.

Na-Like Cu Ion X-Ray Lasing at 72.22 Angstroms Achieved

92P60111A Beijing KEXUE TONGBAO in Chinese Vol 36 No 22, 16-30 Nov 91 pp 1704-1706

[Article by Lu Peixiang [7120 1014 4382], Zhang Zhengquan [1728 2973 3123], et al. of the CAS Shanghai Institute of Optics and Fine Mechanics (SIOFM), Shanghai 201800: "Sodium-Like Copper Ion 72.22-Angstrom Compound X-Ray Laser"; MS received 24 Nov 90]

[Abstract] Using an appropriate combination-pumped laser (pulse width of 900 ps, on-target laser energy of 60 J), SIOFM scientists working with their LF12 laser apparatus have conducted experimental research on Na-like Cu ion soft X-ray lasing, and have achieved Na-like Cu ion soft X-ray lasing at 72.22 Angstroms (the 6g-4f transition). Drive laser wavelength is 1.05 µm, and laser input is focused onto the planar target via a six-element compound cylindrical lens-aspheric lens system. Homogeneous-radiation focal-line length is 18 mm, focal-line width is 130 µm, and the corresponding on-target laser power density is 2.5 x 10^{12} W/cm^2. The authors also employed an independently developed Michaud astigmatic grazing-incidence-grating spectroscope with a 20-120-Angstrom spectral range, a spectral resolution of better than 50 milliAngstroms, and a one-dimensional spatial resolution of better than 50 µm. Standard Kodak 101-01 X-ray film supplied by Professor Schaefer was used. Three figures show various spectral plots.

References

1. Matthews, D. L., Hagelstein, P. L., et al., PHYS. REV. LETT., 54 (1985), 110.

2. MacGowan, B. J., Maxon, S., et al., PHYS. REV. LETT., 59 (1987), 2157.

3. Suckewer, S., Skinner, C. H., et al., PHYS. REV. LETT., 55 (1985), 1753.

4. Jaegle, P., Jamelot, G., et al., J. OPT. SOC. AM., B4 (1987), 563; Jaegle, P., Carillon, A., et al., EUROPHYS. LETT., 7 (1988), 337.

5. Xu, Z., Zhang, Z., et al., APPLIED PHYSICS B, B50 (1950), 147.

6. Key, M. H., J. PHYSIQUE, Colloque C1, Supplement au no.T, 49 (1988), C1-135.

7. Brown, C. M., Seely, J. F., et al., J. OPT. SOC. AM., B3 (1986), 701.

8. Lewis, C. L. S., O'Neill, D., et al., Rutherford Appleton Laboratory Annual Report, RAL-88-042 (1988), 19.

9. Chen, W., Wang, S., et al., Paper: CWF42, CLEO'90, Anaheim, 21-25 May 1990.

10. Zhang Zhengquan, Fan Pinzhong, et al., GUANGXUE XUEBAO [ACTA OPTICA SINICA], 8 (1988), 762.

11. Feng Xianping, Xu Zhizhan, et al., GUANGXUE XUEBAO [ACTA OPTICA SINICA], 9 (1989), 680.

12. Kishimoto, T., Report of Max-Planck-Institut fur Quantenoptik, Garching, 108 (1985), 70.

13. Linford, G. J., Peressini, E. R., et al., APPL. OPT., 13 (1974), 397.

Electron Trajectories and Stability in FEL With an Axial Guide Magnetic Field

40100013A Beijing WULI XUEBAO [ACTA PHYSICA SINICA] in Chinese Vol 40 No 10, Oct 91 pp 1624-1631

[English abstract of article by Shu Xiaojian of the Institute of Applied Physics and Computational Mathematics, Beijing, 100088; MS received 14 Nov 90]

[Text] The single-particle trajectories of relativistic electrons are studied in a magnetic field configuration consisting of a uniform axial guide field and a helical periodic wiggler field. The steady-state trajectories and the first-order perturbed trajectories are analysed carefully. Based on the numerical simulations about the experiments which have been made at Shanghai Institute of Optics and Fine Mechanics, the effect of the betatron oscillations due to the transverse varying of wiggler field is first shown in the case that there is an axial guide field. In this case the betatron oscillations equations are derived. Its period and the relation between phase in X direction and in Y direction are obtained. Furthermore, numerical simulations are made. The results of analytical calculations are in good agreement with the numerical simulations.

Stimulated Raman Scattering in Laser-Plasma Targets

40100013B Beijing WULI XUEBAO [ACTA PHYSICA SINICA] in Chinese Vol 40 No 10, Oct 91 pp 1642-1651

[English abstract of article by Zhang Jiatai, Xu Linbao, Chang Tieqiang, Zhang Shugui, Nie Xiaobo, Wang Shihong, and Wang Weixing of the Institute of Applied Physics and Computational Mathematics, Beijing, 100088; MS received 12 Nov 90]

[Text] A one and a half dimensional (1 ½ - D, one space dimension and two velocity dimensions) plasma cloud-in-cell simulation code (CIC) has been developed. It is used to study SRS in laser-plasma targets from the Shenguang-12$^{\#}$ Nd-glass laser facility ($\lambda = 1.053$ µm, $\tau = 850$ ps, $I_L = 3 \times 10^{14} - 3 \times 10^{15}$ Wcm^{-2}). Results on the linear growth rates of the scattering electromagnetic waves and Langmuir waves and nonlinear saturation are obtained in detail. Other results such as the time development of the electron distribution function and temperature and fraction of hot electrons are also presented.

In addition, temperature of thermal electrons (1.4 - 2.5 keV) in the underdense coronal plasma region is determined by spectrum analysis of SRS light, as well as contour figure for density distribution and average density (0.12 - 0.14 n_c, $n \leq 1/4\ n_c$). These results agree with experiments.

Industrial Computerized Fault-Detection Scanning Imager Developed

92P60093A Beijing ZHONGGUO KEXUE BAO [CHINESE SCIENCE NEWS] in Chinese 29 Nov 91 p 1

[Article by Peng Dejian [1756 1795 1696]: "Industrial Computerized Fault Scanning Imaging Apparatus Developed"]

[Summary] Hefei (ZHONGGUO KEXUE BAO wire report)—An industrial computerized fault scanning imaging apparatus (or ICT [industrial computerized tomography] apparatus) developed by a team of over 30 Hefei Industrial University (HIU) researchers and graduate students led by Associate Professors Xu Jiahua [1776 1367 7520] and Lu Zaiqing [7120 0961 1987] successfully achieved weak-source image output on the morning of 3 November. This technology, principally used for high-accuracy non-destructive testing to detect faults in metallic and non-metallic structures, uses gamma rays as the radiation source and is considerably more complex than the CT [computerized tomography] technology used in hospitals. Only a few industrially developed nations have heretofore applied ICT technology, which is useful in areas such as aerospace and petroleum exploration. HIU's development of the ICT device, described as an intermediate apparatus—i.e., at a stage between an experimental unit and an industrial prototype—is a national-level 1991 Torch Plan project, and was assisted by Institute 7 of the China Academy of Engineering Physics (CAEP) and by Institute 720 of Sichuan University.

Ku-Band GaAs Oscillator, Other MMICs Pass Appraisal

92P60116C Beijing ZHONGGUO DIANZI BAO [CHINA ELECTRONICS NEWS] in Chinese 3 Jan 92 p 3

[Article by Li Qiongrui [2621 8825 3843]: "New Advances in Monolithic Integrated Circuit Development: Ku-Band GaAs Monolithic Oscillator, Other Achievements Pass Appraisal"]

[Summary] Over the past year, MMEI's Institute 13 has made remarkable progress in development of monolithic microwave integrated circuits (MMICs). The institute's Ku-band GaAs monolithic oscillator and three other GaAs MMICs, as well as three silicon monolithic ICs including an analog electronic switch with a high-speed driver, all passed expert technical appraisal over this 12-month period. The institute developed the type CL50 domestic first-generation GaAs monolithic low-noise IC and type JGF353 first-generation GaAs monolithic power IC, following those up with its 1990 design finalization for the first domestic Ku-band GaAs monolithic power IC (15 GHz, 100 mW), its 1991 unveiling of the first [domestic] Ku-band (14-18 GHz) GaAs monolithic oscillator, C-band (5.39-6 GHz) low-noise monolithic IC, type XN511 GaAs high-speed analog electronic switch IC, type X-11 GaAs monolithic integrated laser drive circuit, and other devices. Of these, the Ku-band oscillator has an oscillating output power of over 30 mW at 15 GHz, over 20 mW at 16 GHz, and up to 10 mW at 18 GHz. The XN511 electronic switch has high isolation (60 dB), low on-state resistance (25 Ω), and low drive power loss (almost none). The laser drive circuit, whose development was an 863 Plan project, has a drive power exceeding 30 mW and a transmission speed of 800 Mbits/s. Among the silicon monolithic ICs developed by the institute, the type XN461-463 analog electronic switch with high-speed driver, the type XN471-472 monolithic double-throw analog electronic switch and three other devices have been appraised to meet mid-to-late eighties international standards.

Micro-Package Hybrid IC Product Series Unveiled

92P60116B Beijing ZHONGGUO DIANZI BAO [CHINA ELECTRONICS NEWS] in Chinese 1 Jan 92 p 1

[Article by Li Qiongrui [2621 8825 3843]: "Microelectronics Park Reaps Rich Fruits"]

[Summary] Chinese researchers have recently developed over 40 varieties of micro-package hybrid ICs in several series. This breakthrough, which extended from the end of the Seventh 5-Year Plan into the first year of the Eighth 5-Year Plan, was announced on 25 December 1991 at an S&T achievement appraisal convened by MMEI's Institute 13. One example of such a circuit is the micro-integrated broadband large-dynamic-range low-noise amplifier (LNA), which consists of a 6.5 mm x 6.5 mm thin-film circuit substrate onto which are integrated the amplifier circuit, active bias circuit, capacitors, resistors, and other elements, all of this encapsulated in a metal package with a diameter not over 12 mm. These micro-package hybrid ICs are used in electronic countermeasures, radar, communications, aerospace, and other fields requiring tiny, highly reliable ICs. Institute 13, the first domestic research institute to develop such circuits, is also the only domestic institute able to provide them in a number of varieties. Institute 13's HE series of micro-package hybrid ICs, developed in 1991, consists of 20 varieties in six types, including the LNA, a power amplifier, a broadband VCO, and a broadband electrically tuned attenuator.

Shougang Corp., NEC Form Microelectronics Joint Venture

92P60116A Beijing ZHONGGUO DIANZI BAO [CHINA ELECTRONICS NEWS] in Chinese 20 Dec 91 p 1

[Article by Shu Guang [2562 0342]: "Shougang, NEC Jointly Building Microelectronics Engineering Facility"]

[Summary] Shougang-NEC Electronics Ltd., a microelectronics engineering joint venture between the Shougang Corp. and Japan's NEC, was formally established on 12 December in Beijing with a ribbon-cutting ceremony to initiate the construction in the Shijingshan district. This microelectronics joint venture, whose construction is funded by a gross investment of 26 billion yen (60 percent from Shougang and 40 percent from NEC), will use NEC's production and management technology, including advanced LSI circuit diffusion and packaging production lines and testing equipment. Completion of construction on the new facility is estimated to take 2 years. The new firm will engage in IC development, design, production, sales, and service. Annual production of MOS ICs and bipolar ICs (130 varieties in 11 major categories) is expected to reach 50 million, part of which will be sold on the international market. Term of the joint-venture agreement is 20 years.

Hangzhou Corporation, Toshiba Corp. Form Joint Venture To Produce Spare Parts

92P60091A Beijing ZHONGGUO DIANZI BAO [CHINA ELECTRONICS NEWS] in Chinese 1 Dec 91 p 1

[Article by Lu Minmin [0712 2404 2404]: "Sino-Japanese Joint-Venture Industrial Base for Electronics Spare Parts: Agreement Signed in Hangzhou To Form Hang Zhi Ltd."]

[Summary] An agreement to set up Hang Zhi [2635 5347] Ltd., a joint venture between Japan's Toshiba Corp. and the Hangzhou Electromechanical Industries Development Corp., was formally reached in Hangzhou on 14 November. This joint venture, which will concentrate on manufacture of electronics spare parts, is the first direct-investment-operated joint venture set up by Toshiba Corp. in this nation.

Capitalized with a gross investment of 1.75 billion yen, 22 percent from the Chinese side and 78 percent from the Japanese side, the new joint venture will produce parts for a variety of Toshiba products, and will also engage in software technology development fully utilizing the skills of domestic programmers. Hang Zhi Ltd. will operate under the Japanese style of business management. Raw materials will be purchased from Chinese suppliers at a rate gradually increasing to over 80 percent. When the facility is completed, it will be the largest domestic base for production and export of electronics spare parts, as well as the largest joint venture in the Hangzhou New High-Tech Industrial Development Zone.

Long-Wavelength Low-Dark-Current High-Speed $In_{0.53}Ga_{0.47}$ As MSM Photodetectors

40100015A Beijing BANDAOTI XUEBAO [CHINESE JOURNAL OF SEMICONDUCTORS] in Chinese Vol 12 No 12, Dec 91 (manuscript received 18 Sep 90, revised 20 Dec 90) pp 767-770

[Article by Shi Changxin (Institute of Microelectronics Technology, Shanghai Jiaotong University, Shanghai, China) and Klaus Heime (Institute of Semiconductor Electronics, Technical University of Aachen, Aachen, W. Germany)]

[Abstract] A long-wavelength, low-dark-current, high-speed $In_{0.53}Ga_{0.47}$ As Metal-Semiconductor-Metal Photodetector (MSM-P) with undoped InP Schottky-barrier enhancement layer, grown by LP-MOVPE [low-pressure metallo-organic vapor phase epitaxy] is reported. Values of 60 nA of dark current (100X100)μm^2 at 1.5V, 30ps of rise time and 0.42A/W of responsivity at 6V are obtained.

New World Record Established for HTS YBCO Critical Current Density

92P60102A Beijing RENMIN RIBAO in Chinese 23 Dec 91 p 3

[Unattributed article: "Nation's High-Temperature Superconducting Material Critical Current Density Takes Leading Position"]

[Summary] Beijing, 20 Dec (XINHUA)—A result achieved in a recent experiment conducted by the CAS Shanghai Institute of Metallurgy is at the international state-of-the-art. Using the melt-textured growth (MTG) technique, the Shanghai scientists fabricated a YBCO superconducting material that has a critical current density exceeding 97,000 A/cm^2 at a critical temperature of 77K and in the presence of a 7.5-8.8-tesla magnetic field. This value for critical current density surpasses the previous world record of 24,000 A/cm^2 for a YBCO superconductor with the same critical temperature and with a magnetic field of 5 tesla. The Shanghai institute's measurements were confirmed by continuous dc tests conducted at Fudan University and at the State Superconductivity Center.

Further Reports on Fiber Optic Communications

Another Jiangsu Province Trunkline Built

92P60117A Beijing DIANXIN JISHU [TELECOMMUNICATIONS TECHNOLOGY] in Chinese No 12, Dec 91 p 48

[Untitled news brief by Jin Yuqi [6855 6877 3825]]

[Summary] Construction on another high-capacity fiber optic cable for Jiangsu Province's long-distance communications network began in October 1991, and the cable should be completed and put into operation by February 1992. The new trunkline's southern end connected to the Shanghai-Nanjing fiber optic cable, and its northern end is the open harbor town of Zhangjiagang. This 91-km-long trunkline uses domestically made equipment throughout: the 140 Mbit/s [DS4] 1.3 µm single-mode fiber optic cable is manufactured by MPT's Houma Cable Plant, and the 34 Mbit/s [DS3] optical circuit multiplexing equipment for the optical terminals is manufactured by MPT's Wuhan Institute of P&T Science.

Fujian Cable Under Construction

92P60117B Beijing KEJI RIBAO [SCIENCE AND TECHNOLOGY DAILY] in Chinese 21 Dec 91 p 2

[Article by You Xin [1429 2450]: "One-Third of Construction on Fujian Segment of Southern Seacoast Fiber Optic Cable Communications Trunkline Completed"]

[Summary] One-third of the construction on the Fujian segment of the southern seacoast fiber optic cable communications trunkline—a key state Eighth 5-Year Plan project—has been completed after only 2 months: 326 km of cable have been laid, and the entire 862 km stretch of the line residing in Fujian Province should be laid by early next year [i.e., 1992]. Opening of this line will provide customers in the 24 economically developed counties and cities along the southern seacoast with over 8,000 inter-provincial long-distance telephone circuits and over 20,000 intra-provincial long-distance circuits.

Beijing-Zhengzhou Railroad Communications Cable

92P60117C Beijing KEJI RIBAO [SCIENCE AND TECHNOLOGY DAILY] in Chinese 30 Dec 91 p 1

[Article by Peng Hengcai [1756 0077 2088]: "Beijing-Zhengzhou Railroad Fiber Optic Cable Communications Line Operational"]

[Summary] The Beijing-to-Zhengzhou railroad fiber optic cable communications system became fully operational on 26 December. This system—whose construction was included in the first batch of State pilot demonstration projects in fiber optic communications—is the nation's currently longest-range, highest capacity railroad optical fiber communications system. This 730-km-long line uses advanced single-mode-fiber DS4 [140 Mbits/s] optical communications equipment. Trunkline capacity is 1,920 circuits. Main construction was handled by the Shanghai Engineering Co. of the Ministry of Railways' Communications Signals Corporation.

Fiber Coatings Domestically Developed

92P60117D Beijing KEJI RIBAO [SCIENCE AND TECHNOLOGY DAILY] in Chinese 6 Jan 92 p 1

[Article by Ruan Xianghua [7086 3276 5478]: "Domestically Made Optical Fiber Coatings Developed"]

[Summary] Two new optical fiber coatings developed by the Hubei Province Institute of Chemistry with the assistance of MPT's Wuhan Institute of P&T Science recently passed the expert appraisal organized by the Ministry of Chemical Industry. The "WF-103 rapid solidifying outer-layer coating material" and the "WF-104 silicon ketone optical fiber coating material" newly developed by the institutes follow upon the "WF-101" and "WF-102" types of UV-light solidified single-layer optical fiber coating materials developed by the institutes in 1987. The new coatings will provide an important boost to the development of the domestic fiber optic communications industry.

Zhejiang Eighth 5-Year Plan Projects Detailed

92P60084A Beijing DIANXIN JISHU in Chinese No 11, Nov 91 pp 2-4

[Article by Tu Yonghe [1458 3938 0735], assistant director of the Zhejiang Province P&T Management Office: "Strengthen Telecommunications Network Construction; Enhance Integrated Communications Power"]

[Excerpts] [passage omitted]

III. Eighth 5-Year Plan Communications Construction Projects

The following telecommunications network construction projects are scheduled to be implemented during the Eighth 5-Year Plan:

1. Construction of Digitized Transmission Networks

Except for Zhoushan Prefecture, where DMW lines will be used due to geographical limitations, all efforts will be exerted toward construction of buried DS4 [140 Mbit/s, 1,920 voice circuits] fiber-optic cables between Hangzhou and all municipalities and prefectures, and of overhead DS3 [34 Mbit/s, 480 voice circuits] and DS4 fiber-optic cables between the municipalities/prefectures and the counties. The specific planned projects are:

(1) The Jiaxing-Hangzhou-Shaoxing-Ningbo-Taizhou [Prefecture]-Wenzhou municipal/prefectural buried fiber-optic cable project and four other similar projects, with all five projects totaling 1,510 km of cable. The Jiaxing-Hangzhou-Shaoxing-Ningbo-Taizhou-Wenzhou project construction is to be coordinated with MPT's Shanghai-Fujian Province fiber-optic cable construction project. This [Shanghai-Fujian] fiber-optic cable line

cuts through the most economically developed prefectures of the Zhejiang seacoast, includes 23 municipalities and counties, and is 862 km in overall length. It is the principal Zhejiang Province trunkline fiber-optic cable. The now-being-built Hangzhou-Fuyang-Tonglu-Jiande-Lanxi-Jinhua fiber-optic cable project hopefully will be completed by the end of the year [i.e., 1991], and its completion should relieve the currently overcrowded situation in the Hangzhou area.

(2) The Hangzhou-Heng'an and seven other municipal and prefectural county-administered DS3 overhead fiber-optic cable projects, with all eight projects totaling 717 km.

(3) The Jiande-Chun'an and four other county (city)-to-county (city) fiber-optic cable projects, all using DS3 overhead fiber-optic cable and totaling 330 km.

This entire fiber-optic cable project construction will be divided into two phases, according to requirements: first-phase construction consists of 1,310 km of buried fiber-optic cable and 582 km of overhead fiber-optic cable, while second-phase construction consists of 200 km of buried fiber-optic cable and 498 km of overhead fiber-optic cable. [passage omitted]

Hunan Province Projects Described

92P60084B Beijing DIANXIN JISHU in Chinese No 11, Nov 91 p 47

[Unattributed news brief]

[Text] In order to rectify the backward communications in 27 western and southern counties, the Hunan Province P&T Management Office will import optical communications equipment from Britain. The authorities plan to build 140 Mbit/s [DS4] overhead fiber-optic cables from Huaihua to Dayong (340 km) and from Hengyang to Chenzhou (514 km) as well as the 560-km-long extension lines to these circuits. Groundbreaking is scheduled for the second half of next year [i.e., 1992], and initial operation is set for 1994.

Nanjing-Wuhu Railroad Communications Line Operational

92P60103A Beijing ZHONGGUO DIANZI BAO in Chinese 8 Dec 91 p 1

[Article Yi Wu [0076 2976]: "Nanjing-Wuhu Railroad Fiber-Optic Cable Communications System Operational"]

[Summary] The Nanjing-to-Wuhu railroad long-distance trunkline fiber-optic cable communications system, one of the second group of State Fiber-Optic Communications Demonstration Pilot Projects, became formally operational (full line) on 2 December. The entire 110-km length of this line is unrepeatered. The project incorporates the nation's first independently designed and installed 1.55-micron-wavelength single-mode fiber-optic cable communications system. Cable laying, connections, and testing were handled by the Beijing Optical Communications Company (BOCC). The cable, supplied by Northern Jiaotong University, has a newly developed structure and is called bundle-tube [shu guan shi 2631 4619 1709] cable. Stainless-steel fiber-optic cable connectors were specially designed for the bundle-tube cable by BOCC engineers; these connectors and related devices have received state patents. The optical loss design parameter for the entire length of the system was 36dB, but since stringent QC standards were employed by the BOCC engineers, the measured loss for the entire line is under 30dB. Connection-point loss was designed to be no greater than 0.12dB, but with the use of advanced fusion splicers, the engineers were able to cut this loss to under 0.06dB.

Shanghai-Nanjing Cable To Be Operational by End of 1992

92P60103B Beijing JISUANJI SHIJIE in Chinese No 48, 11 Dec 91 p 5

[Article by Xing Hua [5281 5478]: "Shanghai-Nanjing Fiber-Optic Cable Communications Trunkline To Be Completed Next Year"]

[Summary] The Shanghai-to-Nanjing fiber-optic cable communications trunkline, jointly funded and constructed by MPT and by Jiangsu Province, will be completely laid by early next year [i.e. 1992] and should be operational by the end of next year. This 400-km-long line, of which 350 km are in Jiangsu Province, runs through Zhenjiang, Changzhou, Wuxi, and Suzhou cities, and incorporates 22-fiber cable imported from Japan. In the initial phase, four DS4 [140 Mbps] 1,920-voice-circuit digital lines are being installed and opened up, while long-range plans call for expansion into a DS5 [565 Mbps] fiber-optic cable transmission system capable of providing over 100,000 long-distance voice circuits.

High-Capacity SPC Digital Switch Domestically Developed

92P60104B Beijing RENMIN RIBAO in Chinese 15 Dec 91 p 1

[Article by He Huangbiao [0149 7806 1753] and Zhang Dongwen [1728 2639 2429]: "High-Capacity Stored-Program-Controlled Digital Switchboard Unveiled"]

[Summary] Beijing, 13 Dec (RENMIN RIBAO)—At a joint press conference held the other day by the PLA General Staff Headquarters and by MPT, spokesmen for the two organizations announced development of the highest-capacity domestic stored-program-controlled (SPC) digital switchboard, which has now passed technical appraisal. The HJD-04 SPC digital telephone switch, jointly developed by the PLA's Institute of Information Engineering and by the China MPT Industrial Corporation, represents a major breakthrough in the campaign to modernize the nation's communications technology. With a capacity of 60,000 equivalent lines, the HJD-04 is suitable for a 16,000-line tandem office or a 30,000-40,000-line metropolitan telephone office, and meets late-eighties international standards. Busy-hour call processing potential exceeds 2 million BHCA. In place of the traditional design, this new digital switching network has a fully connected distributed T-type network structure, which raises the degree of terminal "intelligentization." The HJD-04 also represents the first incorporation of real-time multiplexed frequency spectrum analysis technology into a switchboard. It is understood that foreign nations have usually taken seven to eight years to develop such a high-tech product; China has taken only three years and four months to develop this new high-capacity SPC digital switch.

Shanxi Plant Manufactures CDMA Satellite Datacom Network

92P60104A Beijing ZHONGGUO DIANZI BAO in Chinese 13 Dec 91 p 1

[Article by Gu Bingxin [7357 3521 9515]: "Shanxi Markets Code-Division Satellite Data Communications Network"]

[Summary] On 21 November, the first units of a formatted-network satellite communications system developed in an 11-year effort and manufactured by the Shanxi Galaxy Electronic Equipment Plant were shipped. This is the first operational CDMA-SDCN [code-division multiple access] satellite data communications network to be manufactured domestically. This network, meeting late eighties international standards, consists of several small CDMA satcom earth stations forming a networked system that can be used by the military forces and by civilian authorities in area such as petroleum exploration, geological prospecting, electric power, and transportation.

Digital Microwave Projects Described

Contract Signed for Nanchang-Fuzhou DS4 Line

92P60083A Beijing DIANXIN JISHU in Chinese No 11, Nov 91 p 47

[Untitled news brief by Liu Jiuru [0491 0046 1172]]

[Summary] The overall contract for the construction of the MPT level-1-trunkline 140 Mbit/s [DS4] digital microwave (DMW) project connecting Nanchang with Fuzhou was signed in Beijing in June [1991]. MPT was represented by the posts and telecommunications (P&T) offices of Jiangxi and Fujian Provinces; signing on the construction side was the China P&T Industrial Corporation. This 476.7-km-long DMW line will have a total of 11 microwave stations, five (covering 204 km) in Jiangxi Province and six (covering 272.7 km) in Fujian Province. The DS4 DMW equipment, PCM digital multiplexing equipment, power supplies, high-performance antennas and other units are all domestically manufactured and comply with CCIR and CCITT international standards. Terminal testing should be conducted by October 1992.

'Shenda' Superhighway DS2 Line Operational

92P60083B Beijing DIANXIN JISHU in Chinese No 11, Nov 91 p 47

[Untitled news brief by Huang Wenquan [7806 2429 6898]]

[Summary] The "Shenda" superhighway 8 Mbit/s [DS2] DMW project, constructed by the China Communications Construction Company's Xian Engineering Company, passed acceptance check on 10 July [1991] and became formally operational. This 8,820-km-long [as published] DMW line, with eight microwave stations, uses domestically made equipment throughout. The opening of this line will improve management of the "Shenda" superhighway.

Electron-Positron Collider Technology Exported

OW2411153491 Beijing XINHUA in English 1446 GMT 24 Nov 91

[Text] Beijing, November 24 (XINHUA)—China is now exporting its electron-positron collider as a package including construction, shipping, installation, and debugging.

Since 1988, the Institute of High Energy Physics under the Chinese Academy of Sciences has earned more than $3 million by exporting the Beijing electron-positron collider.

In addition, the research required to develop the Beijing electron-positron collider has promoted the development of China's industry and science and technology.

The Institute of High Energy Physics, which is responsible for the construction project, has produced and exported a number of high-tech devices related to the electron-positron collider to countries including the United States, Brazil and Italy.

Luminescence Advances in China

92FE0169A Beijing WULI [PHYSICS] in Chinese Vol 20 No 9, Sep 91 pp 513-518

[Article by Xu Xurong [1776 0650 8833] of the Institute of Material Physics, Tianjin Institute of Technology, and Fan Xiwu [5400 1585 2976] and Liu Hongkai [0491 3163 2818] of Changchun Institute of Physics, the Chinese Academy of Sciences: "Luminescence Advances in China"]

[Text] This paper presents advances in luminescence in China in areas such as physics, materials, device and applications. It also discusses progress of luminescence in several interdisciplinary sciences.

Luminescence is a physical phenomenon associated with the conversion of absorbed energy to light by an object. The contents of interest include the source and structure of the luminescent center, energy states of the matrix and impurity in the luminescent material, and mutual interaction between electrons, phonons and other excited states. Laws of luminescence not only can provide guidance to material selection and preparation but also can be used to create new experimental techniques to more effectively investigate the subject in depth. It eventually become the basis of high technology. A great deal of progress has been made in the study of luminescence, in terms of fundamental theory, materials and devices, and applications.

In the past decade, luminescence has been moving forward. China began to expand the study of luminescence into an area centered around excited state in 1981. It covered a wide variety of materials, including insulators, semiconductors, amorphous materials, organic molecules, polymers and biologic systems. The contents include transient and coherence process, excimer, excimer and collective luminescence, high density excitation and non-linear optical effect, optical properties of quantum well and super lattice, photochemistry and photosynthesis, diagnosis of cancer, etc. Luminescence reveals the excited states and their behavior of materials. It becomes an important means to understand a material and its variations, including its interaction with other matters. It is also closely tied to our social and economic life. In the development of novel and high technology, it is an important cutting edge science associated with physics, optoelectronics, chemical kinetics, photosynthesis and life science.

I. Physics of Luminescence

"Excitation Processes of Condensed Matters" is the nucleus of luminescence physics. A wide range of in-depth studies have been conducted by Chinese researchers. Systematic and thorough studies are being done at a number of institutions, such as China University of Science and Technology, Xiamen University, Fudan University, Beijing University, Tianjin Institute of Technology, Shanghai University of Science and Technology, the Institute of Semiconductors of the Chinese Academy of Sciences, Changchun Institute if Applied Chemistry, Shanghai Institute of Optics and Fine Mechanics of the Chinese Academy of Sciences and Changchun Institute of Physics. Furthermore, each institution has its own unique direction and its own team. For example, China University of Science and Technology primarily concentrates its efforts on three areas, i.e. theoretical and experimental analysis of spectra from amorphous, polycrystalline materials and from synchrotron radiation. New schemes were presented to analyze the spectra of continuously tunable laser crystals to determine the intensity of d-d transition, phonon band edge and spectral shape from a theoretical basis. In addition, the DV-X_d method was developed to calculate the multi-state spectra of transition metal complex ions such as $[CrF_6]^{-3}$ and $[CrC_6]^{-9}$. Luminescence of disorder systems has been systematically investigated. On the basis of energy band analysis, the dependence of luminescent lines of thin diamond film upon excitation energy was calculated. At Xiamen University, electronic structures of III-V and II-VI compounds and mixed crystals were studied using density functional theory and first principle energy band method. On this basis, potential variation due to optical phonon and discontinuity in the valance band at the heterojunction interface for a series of materials were calculated. Electronic structures and electronic states associated with the luminescent centers of alkaline metal sulfide compounds were investigated. The spin-polarized electronic structure and possible source of band edge luminescent peak of ZnMnSe, a semi-magnetic semiconductor, were studied. They also investigated the defects and their causes in GaP and determined its atomic structure and electronic states. They studied the excimer binding mechanism in III-V semiconductors with wide forbidden bands and proved that the excimer binding mechanism agrees with the H-T-L model. At Tianjin Institute of Technology, the effect of the electric field in CdS crystal on its non-linear effect was investigated. The motion of excited states in electroluminescence and factors causing the bottleneck effect were studied. Shanghai University of Science and Technology studied electron transition processes inside luminescent centers of rare earth compounds. Changchun Institute of Applied Chemistry systematically studied the relation between energy level transition at the luminescent center and ligand field, especially $^5D_0$ - ^7F_J transition of f^6 configuration ion of 4f electron in a 32 point group and the J mixing effect of even order terms of the crystal field. They discovered the mechanisms and criteria for the electron cloud expansion effect spectral series, spectral chemistry series and ultrasensitive transition series. They also pointed out the effect of the zero order term of the crystal field on the Slater integral and on the displacement of the configuration center energy level and the effect of cross relaxation on the luminescence of rare earth ions. They also developed equations to calculate cross relaxation probability and concentration quenching, and derived wave functions and energy levels to describe $4f^N$ and $4f^{N-1}n'L'$ configuration using the U group method. The relation between luminescence and the chemical bond in the crystal was investigated. It was found that better luminescent compounds have stronger covalent bonds. The Institute of Semiconductors of the Chinese Academy of Sciences has been concentrating its research efforts on the luminescence and lattice dynamics of III-V compounds under static pressure, energy spectra of in quantum well and super lattice, and luminescence of super heated electrons. They employed picosecond technique to measure sub-energy bands with n = 1, 2, 3, studied impurity luminescence in the center and at the edge of a well in multiple quantum well structures, and determined the dependence of the time constant of super heated electron upon well width and the relaxation of electron temperature. It was discovered that there are two types of quantum wells from low temperature to room temperature. One remains to be operating in the excimer mode and the other shifts into free carrier mode.

A number of open laboratories established in recent years have provided advanced technical resources for the development of optics-based applied basic research. This arrangement attracts novel research topics in luminescence. Open laboratories such as the laboratory of "excited state physics" at Changchun Institute of Physics of the Chinese Academy of Sciences, the "semiconductor and super lattice" laboratory at the Institute of Semiconductors of the Chinese Academy of Sciences, and the "rare earth spectroscopy" laboratory at Changchun Institute of Applied Chemistry, are actively engaged in the study of luminescence. Let us take the laboratory of "excited state physics" at Changchun Institute of Physics of the Chinese Academy of Sciences as an example. The laboratory was established with the approval of the Chinese Academy of Sciences in 1989. It supported 27 projects and partially sponsored 12 "863 Plan" and National Natural Science Foundation programs in 1989. In 1990, this laboratory supported another 12 projects. Using advanced equipment acquired over the years as its resources, this open laboratory organized a strong research team to form an open and flexible system. It begins to shape up as a fundamental research base for luminescence-related physics. During the first year, it attracted 33 projects and 45 guest researchers. It resulted in 97 papers and made a great deal of progress in research in the following three main areas. The first area is non-linearity in semiconductor optics. Optical bistability was implemented for the first time using inner cavity doped semiconductor glass. For the first time, optical bistability was discovered in ZnMnSe single crystal. Furthermore, picosecond optical bistability was observed in ZuSe-ZnTe super lattice. The second area is new light storage materials. For the first time in the world, photon-gated hole-burning through inorganic material at liquid nitrogen temperature was realized. At liquid nitrogen temperature, it is possible to burn 3000 holes within a non-linear profile. In addition, mechanisms for thermal erasure and laser erasure were investigated. The third area is optoelectronic characteristics of organic materials. The structures and characteristics of some organic ligands were determined spectroscopically using rare earth ion probes. It may be applicable to the study of structures and properties of biological macromolecules. In the research of photo-physical behavior of intramolecular electron transfer compounds, frequency doubling effect was found on organic materials. Furthermore, conversion effect was observed in some samples.

II. Luminescent Materials, Devices and Applications

Luminescent materials and devices have a very bright prospect in industrial and agricultural production, medicine and hygiene, and national defense.

High efficiency rare earth lamp with three primary colors is a revolutionary light source for illumination worldwide. It has obvious advantages such as excellent color, long life and high efficiency. It is a key national research and development project. Rare earth fluorescent powders for the three primary colors are the key materials required to develop high performance energy saving lights. There are several dozen institutions involved this area, including Fudan University, Institute of Non-Ferrous Metals, Wuhan University, Changchun Institute of Applied Chemistry of the Chinese Academy of Sciences, Shanghai Yuelong Chemical Corporation, Shanghai Second Specialty Light Bulb Factory, Yingkou Fluorescent Materials Factory, Guangzhou Zhujiang Smelt, and Lanzhou Florescent Materials Plant. Currently, the red fluorescent powder is europium-doped yttrium oxide. The green and blue Florescent powders are polyaluminate activated by europium and terbium, respectively. Although China has the ability to produce rare earth fluorescent powders and energy efficient lamps, however, there are still several performance-related problems comparing to products manufactured abroad. The major ones are low light efficiency, short life, and poor thermal stability. Every research institute and production unit is trying to improve this technology. It is expected that the quality and production capacity of rare earth fluorescent materials and energy efficient lamps will be significantly improved in the Eighth 5-Year Plan.

X-ray Florescent materials are very useful in medicine and industrial production. For many years, Beijing University has studied this area in depth and the effort is apparently effective. X-ray inspection has been widely used in diagnostic radiography, industrial quality control and security check at airport and customs. Among these applications, X-ray diagnosis has the most stringent requirements. They employed a unique technique to develop a barium europium fluorochloride compound which has fine grain size, short after glow and excellent fluorescent property. After it was put in production, they also developed a low cost terbium-based lanthanum gadolinium sulfur oxide fluorescent material. Its unique feature is as a sensitizing screen it has a very fast sensitizing rate. It is 5.7 times of that of a medium speed calcium tungstate. The resolution is 4 line pairs/mm. They also developed an X-ray induced fluorescent material which has more than ten times of the fluorescent efficiency as any conventional X-ray fluorescent material. Thus, X-ray energy can be fully utilized to effectively convert to visible light.

Electroluminescence materials and displays are important components of luminescent materials and devices. More than a dozen institutions, including Changchun Institute of Physics of the Chinese Academy of Sciences, Shanghai Normal University, Tianjin Institute of Technology, Hebei University, China University of Science and Technology, Shanghai University of Science and Technology and Tunxi Automation Element Factory, are engaged in the research and development in this field. Powder type ac and dc electroluminescent screens are used in low intensity displays and large screen displays, In recent years, flexible plastic ac electroluminescent screens have been developed and used in the field. This widens the range of applications of powder electroluminescent screens. Changchun Institute of Physics of the Chinese Academy of Sciences successfully developed a 7.5 m^2 large dot matrix plastic electroluminescent display. It is used as a display terminal at the People's Hall. In addition, this type of electroluminescent display is used in the cockpit as instrument panels on domestically manufactured aircraft. Only a few countries are capable of producing thin film ac electroluminescent displays. In 1989, Changchun Institute of Physics of the Chinese Academy of Sciences also developed a 112 x 192 pixel dot matrix microcomputer terminal screen at a brightness of 93.6 cd/m^2 and resolution of 2 lines/mm. Based on collision excitation cross section, Tianjin Institute of Technology presented a way to accelerate electrons outside the active thin film electroluminescent region to substantially improve the light intensity.

Various light emitting diodes (LED) are widely used. China relies on imported chips to produce LEDs. In 1989 alone, incomplete statistics showed that 560 million LED chips were imported nationwide. Therefore, producing LED chips domestically has been a key assignment for the LED industry in China. In recent years, a number of research and production organizations have devoted considerable efforts to produce LED chips domestically. In order to solve problems associated with the production of high intensity red GaAlAs LED, Changchun Institute of Physics of the Chinese Academy of Sciences, Changchun Semiconductor Company and Suzhou Semiconductor Corporation worked jointly to design and develop advanced epitaxial equipment for production. Suitable technical conditions and processes were found to produce chips with a 4.0 mcd intensity. After sealing, the normal light intensity is 100 mcd. The highest chip intensity is 5.0 mcd. It is an encouraging step toward producing high intensity GaAlAs red LED in China. GaP green LED is another widely used device. Specifically with respect to the production of this chip domestically, Zhejiang University, the Institute of Non-Ferrous Metals, Xiamen University, and Suzhou Semiconductor Corporation did a great deal of work. On the basis of the effect of doping and crystal property on epitaxial GaP material, Zhejiang University designed a five-layer structure to improve the light emitting efficiency. At a forward current injection of 10 mA, the total light flux of the GaP LED chip prepared by liquid phase epitaxy reached 24 mlm. The Institute of Non-Ferrous Metals has the capability to produce GaP wafers in small quantity. Each batch can produce 4 pieces of 45 mm diameter epitaxial wafers. This GaP wafer was made into chips by Changchun Semiconductor Company and a sampling of the green LED showed the following characteristics. At a forward injection current of 10 mA, the mean light emitting intensity is 2.31 mcd and the maximum intensity is 3.65 mcd. The total flux is 32.6 - 48.9 mlm. Suzhou Semiconductor Corporation and Xiamen University also jointly made progress toward domestic production of green GaP LED. It is expected to be able to produce 120 - 200 million chips in the next 2 - 3 years. In recent years, Changchun Institute of Physics of the Chinese Academy of Sciences successfully developed integrated dot matrix LED displays with 36, 72 and 128 pixels. This micro-sized LED device is compact, light weight and uniform in brightness and has excellent optoelectronic isolation characteristics. The 36 pixel integrated LED component has successfully been used in defense-related applications such as a hand-held thermal imaging system and a small ultra-high speed camera. In addition, Shanghai Institute of Metallurgy and Chongqing Institute of Optoelectronic Technology have successfully developed a variety of infrared LEDs which are widely used in automatic control and optical communications.

The research on scintillators is primarily conducted at Beijing Nuclear Instrumentation Corporation. In 1989, it completed the development of a novel acrylic scintillator. It is capable of producing a variety of scintillation plates in quantity up to 100 x 100 x 1 cm^3 in volume. These scintillation plates are used as μ particle detectors in cosmic ray detection arrays. The longest wavelength of the detector is 423 nm and the relative fluorescent efficiency is 26.8 percent (with respect to anthracene crystal). The company also developed a high speed long wavelength liquid scintillator which is comparable in performance to the long wavelength liquid scintillator used by the Americans in neutron imaging during nuclear test. The peak fluorescent wavelength of the scintillator is 820 nm and the decay time is 1.29 ns. Its absolute energy conversion efficiency with respect to X-ray and γ ray is 3.7 x 10^{-4}.

Zhangjiakou Fluorescent Materials Corporation of the Ministry of Railroads developed two permanent β particle excited fluorescent materials. One is a tritium salt produced by reacting tritium with a polymer in liquid and then polymerized into a solid. This salt is dissolved into a solution and the solution is evenly coated over fluorescent particles. The β particles emitted by tritium excite the fluorescent material to produce light. The other is to directly fill light bulbs with tritium gas. β particles released by tritium excite the fluorescent material coated on the inner bulb wall to emit light. It has a brightness of 2 - 6 cd/m^2 and a life of 10 - 20 years. The amount of radioactivity is far below the national safety standard.

III. New Areas

In recent years, the primary characteristic of luminescence is multi-disciplinary involvement. New discovery in luminescence often stimulates research in relevant areas. Similarly, questions in other disciplines may also be answered by research in luminescence. The development of three interdisciplinary sciences is briefly introduced in the following.

1. Luminescence and Optoelectronics

CdS is an excellent luminescent material and has been used for a long time. Recently, it was discovered that composite materials made with ultra-fine CdS particles have very intense optical non-linearity and can be used to fabricate optical bistable devices. Changchun Institute of Physics of the Chinese Academy of Sciences developed several optical bistable devices using a CdS_xSe_{1-x} semiconductor doped glass. They can be classified into the following types by structure. The first is an intrinsic (internal F-P type) array type optical bistable device that has a switch time of 31 ps and mean threshold power of 275 mW. The second is a distributive feedback waveguide optical bistable device that has a switch time of 63 ps and mean threshold power of 77 mW. The third is a internal F-P cavity strip waveguide optical bistable device that has a switch time of 23 ps and mean threshold power of 3 mW.

The advent of semiconductor quantum well and super lattice is a revolutionary event in semiconductor science. Quantum well and super lattice structures made of wide forbidden band II-IV semiconductors have a wide and tunable band width and a higher excimer binding energy. Spontaneous and excited fluorescent in blue, the short wavelength side of the visible spectrum, and optical bistability at ambient temperature are possible. In recent years, Changchun Institute of Physics of the Chinese Academy of Sciences developed a process to prepare high quality ZnSe and ZnS epitaxial films, as well as ZnS_xSe_{1-x} epitaxial film with adjustable composition, using constant pressure MOCVD technique. Multiple layers of ZnSe-ZnS or ZnS_xSe_{1-x}-ZnS are grown on GaAs and CaF_2 substrate, respectively, by MOCVD. The super lattice structure was verified by satellite peak in the X-ray diffraction spectrum. The fact that its electroluminescence peak varies as a function of well width proved that the material has a quantum size effect. Transmission electron microscopy was used to confirm the layer structure. For the first time at 77 K, two peaks in the near band emission region at 421.5 and 390 nm were observed in ZnSe-ZnS super lattice. Based on theory, they can be attributed to electron-heavy hole excimer emission in the ZnSe-ZnS supper lattice well with n = 1, 2. For the first time an emission in the blue with a peak at 448.4 nm was obtained by exciting an epitaxial film prepared by constant pressure MOCVD with a N_2 laser at 337.1 nm. The origin is attributed to excimer-excimer scattering. For the first time at 77 K, excimer type optical bistability of the order of ns was observed with a ZnSe-ZnS supper lattice. Its mechanisms were concluded to be either due to enhanced excimer absorption or excimer dispersion. Recently, optical bistability of the order of 200 - 300 ps was seen in a ZnSe-ZnTe super lattice.

Photon-gated optical storage material was developed in the past few years. It may become a basic technology in the 21st Century. Currently, optical disk has a storage density of 10^8 bits/cm^2. If a photon-gated optical storage material is used, the density may be raised to 10^{11} bit/cm^2. Changchun Institute of Physics of the Chinese Academy of Sciences was the first institution in China to begin research on photo-gated hole-burning and developed organic and inorganic photon-gated optical storage materials. In the area of inorganic materials, the effort was concentrated on photon-gated hole-burning of a family of materials $M_yM'_{1-y}FCl_xBr_{1-x}:Sm^{2+}$ where M and M' are Mg Ca, Sr and Ba. For the first time. photo-gated hole-burning of this type of material was successfully done at liquid nitrogen temperature. The holes could be maintained for 14 days at liquid nitrogen temperature with 40 percent of the area remained. At 4.2 K, it was possible to burn 3000 holes. The holes burned could be erased by either using a laser with a peak wavelength of 514.5 nm or raising the temperature to above 330 K. In the areas of organic materials, four donors, benzoporphyrin zinc, benzoporphyrin magnesium, tetratoluylene benzoporphyrin zinc and tetranaphthyl benzoporphyrin zinc, were developed. At ambient temperature, four photon-gated hole-burning systems using solid p-hydroxyl-benzaldehyde as the receiver and PMMA as the substrate were developed. At 20 K, photon-gated hole-burning was successfully accomplished with these four materials. The hole-burning wavelength is greater than 600 nm. The holes burned at 20 K can be maintained at that temperature for 5 hours without any noticeable change in depth. The holes can be erased when the temperature is raised to 77 K.

Many fields are created by crossing luminescence with optoelectronics. The above is only a few examples.

Major institutions involved in this area of research include the Institute of Semiconductors of the Chinese Academy of Sciences, Shanghai Institute of Metallurgy of the Chinese Academy of Sciences, Shanghai Institute of Optics and Fine Mechanics of the Chinese Academy of Sciences, Fudan University and Changchun Institute of Physics of the Chinese Academy of Sciences.

2. Luminescence and Agriculture

From the viewpoint of physics, the growing and development process in agriculture is an establishment of an optical state. It is a process which requires light modulation. Illuminating condition and light wavelength affect plant growth and composition differently. For example, an increase in infrared irradiation can suppress side root growth and increase the sugar content of the crop. An increase of blue light can suppress stem growth. However, it can raise the protein content. On the basis years of research on bioluminescence and photosynthesis effect, Changchun Institute of Physics of the Chinese Academy of Sciences developed a high light efficiency and high absorption fertilizer, the biological photo-enhancer. This photo-enhancer can increase crop yield because it can emit the kind of light the crop needs to grow so that photosynthesis efficiency is improved. Thus, it accelerates the growth process and helps increase crop yield. Since 1988, this photo-enhancer has been applied in 430,000 mu of farmland, 210,000 mu of corn, 70,000 mu of soy bean, 75,000 mu of rice, 30,000 mu of vegetables and the balance in cotton, fruits and assorted beans. Experimentally, it was established that using this photo-enhancer could significantly improve crop yield. The increase is 10-14 percent for major crop, 10-16 percent for lower-priced crops and 15-30 percent for fruits and vegetables. The expanded use of the photo-enhancer not only created a new way to apply luminescence to agriculture but also established a clear direction for further studies in agricultural physics.

Plastic photo-conversion foil is a novel functional agricultural polymer material. In addition to having characteristics of conventional agricultural sheet, it has the ability to emit light through photo-conversion. It absorbs the harmful ultraviolet light and converts it longer wavelength light which is needed for crops to grow. A cover made of this material can improve temperature, humidity, light and air to help crops grow. Photosynthesis is speeded up to increase the yield. Changchun Institute of Applied Chemistry of the Chinese Academy of Sciences and Changchun Institute of Physics of the Chinese Academy of Sciences are manufacturing this kind of photo-conversion foils. When this photo-conversion foil is used to cover the greenhouse for Changbai ginseng, the number of ginseng produced and the weight for individual ginseng both reach an all time high. From 1983 to 1986, an extra 46 x 10^5 kg of ginseng was produced, creating an economic benefit of 280 million yuan. The quality of Changbai ginseng is also significantly improved. The saponin additivity for a Changbai red ginseng is 1.786 and the total saponin content is 3.27 percent. These indicators are higher than those of Korean ginseng. When photo-conversion sheets are used on the roof of vegetable greenhouse, the yield is significantly increased. For example, cucumber production is increased by 13-17 percent, persimmon by 16.2 percent. This technology is being expanded on a much larger scale.

3. Luminescence and Life Science

Cancer is still a disease without a cure. Early diagnosis is essential. The primary difference between malignant tumor cells and normal cells is that tumor cells split abnormally and grow much faster. Porphyrin compounds are used as energy carriers in all biological species. In malignant tissues porphyrin metabolism is very active. Changchun Institute of Physics of the Chinese Academy of Sciences compared the fluorescent spectra of stomach tissues and sera of normal people and cancer patients and discovered that cancer patients have an extra band in the red centered at 630 nm. Further study revealed that this emission band is due to the transition of conjugate π electron of the Hb porphyrin ring. This fluorescent band is unique to cancer patient. The presence of this band is attributed to the higher than normal porphyrin metabolism in cancer patient. Fluorescent analysis of stomach tissue and serum can be used to diagnose cancer. After a clinical study involving over 1,000 patients, it is over 90 percent accurate. This method is sensitive, easy to perform, very accurate and non-invasive. There is substantial social benefit in the diagnosis and treatment of cancer.

The super weak glow emitted by the human skin is closely related to the activity of all vital organs. It carries important information about life. In metabolic processes, during the oxidation of cells, there is sufficient energy to cause electron transition between different energy levels to produce a super weak luminescence. Studying the pattern of this super weak luminescence will help us understand activities in life. The Institute of Biophysics of the Chinese Academy of Sciences and Shanghai Institute of Traditional Chinese Medicine are engaged in this area of research and have obtained very interesting results. Every part of the human body continually emits some super weak light. There is a fixed pattern of intensity distribution. It is most intense at the finger tips and toe tips and weaker on the arms, legs and body. Although the luminescence is different for different individuals, at different parts of the same individual, or at the same part of the same individual in different conditions, however, for the same part on the same individual over a long period of time, its intensity remains very much constant. When the individual expires, the light also vanishes. The intensity of this super weak luminescence on the human body is related to the individual's health condition. It is a function of the person's physical condition. For example, it is more intense from a laborer or an athlete than an office worker. A master in the Chinese breathing technique emits light several folds higher than that of a normal person. This super weak luminescence can reflect the condition inside a person because the human body has a very rigorous biological automatic control system which also regulates and controls surface luminescence. This super weak luminescence is closely related to the nerve system and circulatory system. It is also very closely tied to the metabolism and biological oxidation processes at the cell level. It is a chemiluminescence and is a sign of life. A great deal of research showed that the super weak luminescence of a healthy human being is symmetric from left to right with a ratio of 1. This symmetric luminescent signal is a function of the conditions of the organs and tissue inside. Therefore, the health of certain organs and tissues can be reflected by the symmetry of the luminescence. Among these luminescent signals, the hands and feet are the most sensitive and convenient to measure. Studies on different diseases revealed that certain diseases have one or several asymmetric points, called pathological luminescent points. It is significant to point out that these points happen to fall on acupuncture points. For example, it falls on the shaoshang point on the thumb for flu, the shaochong point and shaozhe point on the little finger for heart disease, and the yongquan point on the bottom of the foot for renal disease. This diagnostic method is not limited to the diagnosis and identification diseases. It can be used to uncover potential problems. Pathological luminescent points appear on acupuncture points. Moreover, the pattern of light intensity variation is consistent with some of the theories expressed in traditional Chinese medicine. This result indicates that modern scientific instrumentation can be used to measure the variation of super weak luminescence from the human body to further verify theories in traditional Chinese medicine from a scientific perspective.

Luminescence is making giant progress in its traditional domain, as well as in other new areas. In order to meet the economic and defense needs, and to welcome the challenge of high technology, the researchers in luminescence must conduct studies in further depth and breadth.

NTIS
ATTN PROCESS 103 2

5285 PORT ROYAL RD
SPRINGFIELD VA 22161

This is a U.S. Government publication. Its contents in no way represent the policies, views, or attitudes of the U.S. Government. Users of this publication may cite FBIS or JPRS provided they do so in a manner clearly identifying them as the secondary source.

Foreign Broadcast Information Service (FBIS) and Joint Publications Research Service (JPRS) publications contain political, military, economic, environmental, and sociological news, commentary, and other information, as well as scientific and technical data and reports. All information has been obtained from foreign radio and television broadcasts, news agency transmissions, newspapers, books, and periodicals. Items generally are processed from the first or best available sources. It should not be inferred that they have been disseminated only in the medium, in the language, or to the area indicated. Items from foreign language sources are translated; those from English-language sources are transcribed. Except for excluding certain diacritics, FBIS renders personal names and place-names in accordance with the romanization systems approved for U.S. Government publications by the U.S. Board of Geographic Names.

Headlines, editorial reports, and material enclosed in brackets [] are supplied by FBIS/JPRS. Processing indicators such as [Text] or [Excerpts] in the first line of each item indicate how the information was processed from the original. Unfamiliar names rendered phonetically are enclosed in parentheses. Words or names preceded by a question mark and enclosed in parentheses were not clear from the original source but have been supplied as appropriate to the context. Other unattributed parenthetical notes within the body of an item originate with the source. Times within items are as given by the source. Passages in boldface or italics are as published.

SUBSCRIPTION/PROCUREMENT INFORMATION

The FBIS DAILY REPORT contains current news and information and is published Monday through Friday in eight volumes: China, East Europe, Central Eurasia, East Asia, Near East & South Asia, Sub-Saharan Africa, Latin America, and West Europe. Supplements to the DAILY REPORTs may also be available periodically and will be distributed to regular DAILY REPORT subscribers. JPRS publications, which include approximately 50 regional, worldwide, and topical reports, generally contain less time-sensitive information and are published periodically.

Current DAILY REPORTs and JPRS publications are listed in *Government Reports Announcements* issued semimonthly by the National Technical Information Service (NTIS), 5285 Port Royal Road, Springfield, Virginia 22161 and the *Monthly Catalog of U.S. Government Publications* issued by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

The public may subscribe to either hardcover or microfiche versions of the DAILY REPORTs and JPRS publications through NTIS at the above address or by calling (703) 487-4630. Subscription rates will be provided by NTIS upon request. Subscriptions are available outside the United States from NTIS or appointed foreign dealers. New subscribers should expect a 30-day delay in receipt of the first issue.

U.S. Government offices may obtain subscriptions to the DAILY REPORTs or JPRS publications (hardcover or microfiche) at no charge through their sponsoring organizations. For additional information or assistance, call FBIS, (202) 338-6735,or write to P.O. Box 2604, Washington, D.C. 20013. Department of Defense consumers are required to submit requests through appropriate command validation channels to DIA, RTS-2C, Washington, D.C. 20301. (Telephone: (202) 373-3771, Autovon: 243-3771.)

Back issues or single copies of the DAILY REPORTs and JPRS publications are not available. Both the DAILY REPORTs and the JPRS publications are on file for public reference at the Library of Congress and at many Federal Depository Libraries. Reference copies may also be seen at many public and university libraries throughout the United States.